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Scientific and Technical Aerospace Reports (STAR) is a major component of a comprehensive National Aeronautics and Space Administration information system covering aeronautics, space, and supporting disciplines. *STAR* is issued on the 8th and 23rd of each month and announces current publications of the following types:

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By arrangement between NASA and the Smithsonian Science Information Exchange (SSIE), a separate section of information on aerospace-related *On-Going Research Projects* is inserted into each issue of *STAR*. The insert presents titles of active NASA grants and university contracts, summary portions of recently updated *NASA Research and Technology Operating Plans (RTOPs)*, and notices of non-NASA research projects that were funded in the most recent or current fiscal year. The latter are selected by SSIE. The project announcements in the insert are arranged by *STAR* divisions but are otherwise entirely separate from *STAR*. They are not indexed nor machine-searchable by NASA. Current and retrospective searches are available from SSIE, 1730 M Street, N.W., Washington, D.C. 20036.

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Subject scope of *STAR*, *IAA*, and *On-Going Research Projects* includes all aspects of aeronautics and space research and development, supporting basic and applied research, and applications. Aerospace aspects of earth resources, energy development, conservation, oceanography, environmental protection, urban transportation, and other topics of high national priority are also covered.

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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

Each major division is further divided into as many as nine specific categories, which are identified by category numbers.

Abstracts in *STAR* are grouped by specific category, the categories appearing in sequential order. Category breaks in the abstract section are identified by the category number and title, and a scope note. Cross-references to other categories are provided as appropriate. For example:

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

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02 AERODYNAMICS 1799

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

03 AIR TRANSPORTATION AND SAFETY 1802

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 1803

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command and Tracking* and *32 Communications*.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 1804

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

06 AIRCRAFT INSTRUMENTATION 1805

Includes cockpit and cabin display devices, and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

07 AIRCRAFT PROPULSION AND POWER 1805

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

08 AIRCRAFT STABILITY AND CONTROL 1807

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

09 RESEARCH AND SUPPORT FACILITIES (AIR) 1808

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*.

12 ASTRONAUTICS (GENERAL) 1809

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13 ASTRODYNAMICS 1810

Includes powered and free-flight trajectories; and orbit and launching dynamics.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) N.A.

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air)*.

15 LAUNCH VEHICLES AND SPACE VEHICLES 1811

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

16 SPACE TRANSPORTATION 1812

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING N.A.

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 1813

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

19 SPACECRAFT INSTRUMENTATION **N.A.**

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

20 SPACECRAFT PROPULSION AND POWER **1813**

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; and propellants and fuels.

23 CHEMISTRY AND MATERIALS (GENERAL) **1814**

Includes biochemistry and organic chemistry.

24 COMPOSITE MATERIALS **1814**

Includes laminates.

25 INORGANIC AND PHYSICAL CHEMISTRY **1816**

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

26 METALLIC MATERIALS **1818**

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 NONMETALLIC MATERIALS **1824**

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

28 PROPELLANTS AND FUELS **1827**

Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion*.

ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

For related information see also *Physics*.

31 ENGINEERING (GENERAL) **1830**

Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 COMMUNICATIONS **1830**

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

33 ELECTRONICS AND ELECTRICAL ENGINEERING **1838**

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

34 FLUID MECHANICS AND HEAT TRANSFER **1842**

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

35 INSTRUMENTATION AND PHOTOGRAPHY **1847**

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation*.

36 LASERS AND MASERS **1848**

Includes parametric amplifiers.

37 MECHANICAL ENGINEERING **1851**

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY **1854**

Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS **1855**

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

GEOSCIENCES

Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.

For related information see also *Space Sciences*.

42 GEOSCIENCES (GENERAL) **N.A.**

43 EARTH RESOURCES 1859
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For instrumentation see *35 Instrumentation and Photography*.

44 ENERGY PRODUCTION AND CONVERSION 1866
Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation*.

45 ENVIRONMENT POLLUTION 1873
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46 GEOPHYSICS 1875
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For space radiation see *93 Space Radiation*.

47 METEOROLOGY AND CLIMATOLOGY 1881
Includes weather forecasting and modification.

48 OCEANOGRAPHY 1883
Includes biological, dynamic and physical oceanography; and marine resources.

LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and planetary biology.

51 LIFE SCIENCES (GENERAL) 1884
Includes genetics.

52 AEROSPACE MEDICINE 1889
Includes physiological factors; biological effects of radiation; and weightlessness.

53 BEHAVIORAL SCIENCES 1891
Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT 1891
Includes human engineering; biotechnology; and space suits and protective clothing.

55 PLANETARY BIOLOGY N.A.
Includes exobiology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) N.A.

60 COMPUTER OPERATIONS AND HARDWARE 1892
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61 COMPUTER PROGRAMMING AND SOFTWARE 1895
Includes computer programs, routines, and algorithms.

62 COMPUTER SYSTEMS 1898
Includes computer networks.

63 CYBERNETICS 1899
Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support*.

64 NUMERICAL ANALYSIS 1899
Includes iteration, difference equations, and numerical approximation.

65 STATISTICS AND PROBABILITY 1904
Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS 1907
Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS 1907
Includes topology and number theory.

PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.
For related information see also *Engineering*.

70 PHYSICS (GENERAL) 1908
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71 ACOUSTICS 1908
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72 ATOMIC AND MOLECULAR PHYSICS 1910
Includes atomic structure and molecular spectra.

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74 OPTICS 1912
Includes light phenomena.

75 PLASMA PHYSICS 1914
Includes magnetohydrodynamics and plasma fusion.
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76 SOLID-STATE PHYSICS 1918
Includes superconductivity.
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77 THERMODYNAMICS AND STATISTICAL PHYSICS 1922
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 1923
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 1923
Includes information storage and retrieval technology; micrography; and library science.
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83 ECONOMICS AND COST ANALYSIS N.A.
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 1924
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 1925
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 1926
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 1927
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 1928
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 1929
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 1930
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL 1930

Note: N.A. means that no abstracts were assigned to this category for this issue.

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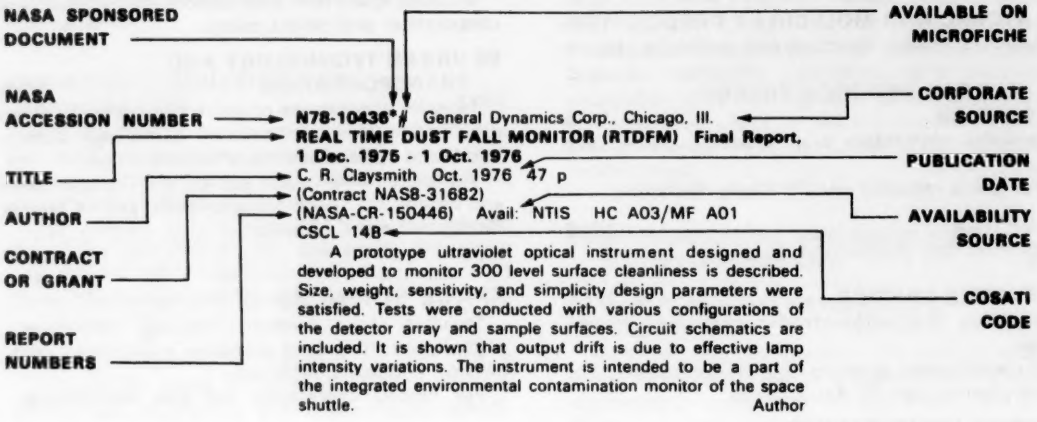
TYPICAL CITATION AND ABSTRACT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NASA ACCESSION NUMBER
N78-10436*# General Dynamics Corp., Chicago, Ill.
CORPORATE SOURCE
REAL TIME DUST FALL MONITOR (RTDFM) Final Report, 1 Dec. 1975 - 1 Oct. 1976
TITLE
PUBLICATION DATE
C. R. Claysmith Oct. 1976 47 p
AUTHOR
(Contract NAS8-31682)
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CONTRACT OR GRANT
(NASA-CR-150446) Avail: NTIS HC A03/MF A01
CSCL 14B
A prototype ultraviolet optical instrument designed and developed to monitor 300 level surface cleanliness is described. Size, weight, sensitivity, and simplicity design parameters were satisfied. Tests were conducted with various configurations of the detector array and sample surfaces. Circuit schematics are included. It is shown that output drift is due to effective lamp intensity variations. The instrument is intended to be a part of the integrated environmental contamination monitor of the space shuttle.
COSATI CODE
REPORT NUMBERS
Author

ON-GOING RESEARCH PROJECTS

This is a listing of research projects — not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, ALTERNATE SUBSONIC LOW-COST ENGINE
C. BAERST, Signal Companies Incorporated, *Phoenix, Arizona* 85034 (DF458250; F33615-76-C-2063)

The objective of this effort is to demonstrate a low-cost expendable subsonic air-breathing engine in the 200 lb thrust class.

A 200 lb thrust expendable engine is under development. The engine utilizes turbo-machine components from commercial truck turbochargers, and has a sudden expansion type afterburner based on ramjet ramburner technology. A production cost estimate will be made for the engine.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

1.0002, FLIGHT TEST HEATING EXPERIMENT
W. SHIH, Science Applications Inc., *La Jolla, California* 92037 (DF139840; F33615-77-C-3043)

Interference heating is the most significant but least understood of the aerothermodynamic problems of designing a high-speed aircraft. Though the effects are highly localized, the heating rates due to shock wave impingement are severe. Of particular concern is the heat conducted into the actuating mechanism of missile control fins, since bearing surfaces and hydraulic systems have relatively low temperature limits. Exceeding these limits could result in loss of flight vehicle control. Since these structural temperatures are directly related and sensitive to the surface heating rates, the interference heating must be defined. Therefore, the objective of this effort is to develop and design an aerodynamic heating experiment for the National Hypersonic Flight Research Facility or similar vehicle to validate and extend ground-based test data and analyses on three-dimensional shock interaction phenomena.

Current and future correlations of ground test data will be used to determine the size and location of the experiment and also to assure the NHFRF will not be adversely affected. The size, location and type of instrumentation must be determined through analysis and experimentation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0003, AIRCRAFT TRANSPARENCY FAILURE AND COST ANALYSIS
W.D. DOTSETH, Rockwell International Corp., *Los Angeles, California* 90009 (DF140130; F33615-77-C-3060)

The logistics or ownership cost of current aircraft transparency systems varies radically for each new system and cannot be accurately predicted. This is not only true for the replacement costs but also for the initial development costs where different design concepts are being considered. The costs are highly sensitive to the particular design configuration. The objective of this effort is to define the most significant design parameters affecting the logistics costs of aircraft transparency systems for current inventory aircraft and project the ownership costs for future systems such as the B-1 and F-16. Corrective programs to reduce AFLC support costs will be recommended.

An initial data search utilizing current AFLC data systems has yielded work unit code reliability, maintainability and logistics support cost information on 20 aircraft transparency systems. The approach is to conduct a combined USAF and contractor field audit at the AFLC AMA's to correlate the initial data search information with actual field experience. Hardware design information, design and test requirements and certification/qualification test results will be collected for each of the systems. A resulting analytical analysis will be conducted to establish the failure/cost relationships with the transparency design parameters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0004, MECHANICAL POWER SYSTEM FOR AIRCRAFT INTERMITTENT UTILITY FUNCTIONS
W. HELSLEY, Rockwell International Corp., *Los Angeles, California* 90009 (DF452880; F33615-75-C-2011)

The objective of this program is to design, fabricate and demonstrate a mechanical power package for controlling and powering a high-horsepower utility actuator function. The mechanical power package will consist basically of an hydraulic motor, flywheel, power controller, and associated components required for integration into a single package.

The program will consist of (1) selection of an intermittent duty function presently performed on an aircraft in service, (2) establishment of power requirements and duty cycle of a mechanical power package (MPP) to perform the selected work functions, (3) design and fabrication of the mechanical power package for the selected work function, (4) establish the test plan for demonstration of MPP, (5) conduct performance tests of MPP on aircraft iron bird, (6) conduct indurance test of MPP to demonstrate its ability to operate satisfactorily for the life of the aircraft, and (7) preparation of the final report.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

1.0005, NAVY VEHICLE DESIGN AND CONSTRUCTION - AIRCRAFT SPIN ENTRY
S.B. SPANGLER, Nielsen Engin. & Research Inc., *Mountain View, California* 94040 (DN475399; N00014-74-C-0344)

This investigation shall determine the forces acting in high-performance aircraft spin entry, and examine design approaches to reduce or eliminate spin tendency. Inadvertent spin at high angles of attack reduces operational effectiveness and frequently results in aircraft loss. Development of technology that can solve spin entry problems is preferrable to dependence on training of air crews in spin recovery techniques that do not always work.

Analysis of the developed theories and methodologies will be completed by comparisons with wind tunnel data of operational aircraft. Improvements in accuracy, techniques, and required computational time will be incorporated in the program. Specific design characteristics or trends that aid or eliminate the undesirable spin characteristics will be identified. The final report will summarize methods of analysis and their capability to predict important fluid flow phenomena of high-angle-of-attack flows.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0006, HIGH-POWER MHD SYSTEM (HPMS)
O. SONJU, Maxwell Laboratories Inc., *San Diego, California* 92123 (DF460230; F33615-76-C-2104)

To obtain test data on a high-performance combustion MHD system. To obtain design data on advanced MHD power systems.

The program consists of a test portion and a detailed design portion. Contractor will provide a hot gas flow train system for power testing using the modified Viking magnet system at AEDC. The critical power testing will take place at AEDC to demonstrate the predicted performance parameters of 30 megawatts, 200 megawatts per cubic meter, and one megajoule per kilogram.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

1.0007, AAH CONCEPT FORMULATION STUDY, DEVICE 2B40
M. RUTHERFORD, Canadian Aircraft & Elect. Ltd, *Montreal, Quebec, Canada* (DA0R4995; N61339-77-C-0047)

Procure a concept formulation study to determine the optimum design of device 2B40, AH-64 flight & weapons simulator. It is desired that the study provide particular attention to the following areas: (A) Visual system: (1) Provide day-night tactical terrain flight capability (2) provide realistic simulation of: a. Visionic equipment b. Air to ground weapons delivery c. Target designation systems d. Enemy threat capabilities (3) Determine the optimum FOV to support typical AAH tactical operations. (B) Flight simulator: (1) Evaluate the requirement for a motion system(s) and provide such systems as needed. (2) Provide a computer system that will include a minimum of 100 percent spare at the time of device delivey.

Award study contracts to three separate organizations to assure a broad spectrum of approaches to solving the problem.

SUPPORTED BY U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command

1.0008, INVESTIGATION OF CENTRIFUGAL EFFECTS ON TURBINE ROTOR FILM COOLING
M.J. BLAIR, United Technologies Corp., *Hartford, Connecticut* 06108 (DF461600; F33615-77-C-2068)

Determine the influence of centrifugal force on the coolant film distribution on a rotating turbine blade. Analysis indicates that where free-stream velocity is low, e.g., the stagnation region, the induced radial velocities signficantly alter the expected coolant distribution.

Determine coolant trajectories on a rotating blade using flow visualization techniques, then measure heat transfer to the rotating blade with instruments located per the visualization tests.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

1.0009, TOWER MEASUREMENTS OF AIRCRAFT PLUME RISE
H.M. SEGAL, U.S. Dept. of Transportation, Fed. Aviation Administration, *Washington, District of Columbia* 20590 (DF409450)

To determine the plume rise from aircraft exhaust emissions. Measured air quality levels have been below predicted concentrations in past FAA and USAF studies. One possible explanation is that the exhaust plume is rising above ground level measurement stations. This program will aid in determining if this is the case. Results will be related to the Williams AFB ambient air monitoring study 19005A12.

Two towers will be instrumented to measure carbon monoxide as a function of elevation. Plume centers and widths will be correlated with meteorological parameters. This is a feasibility study and is not expected to give comprehensive plume rise equations. The study will be at Dulles Airport since the towers, instrumentation, and FAA support are available as part of the FAA's Concorde measurement program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Civil & Environmental Engineering Development Office

1.0010, TRANSONIC AERODYNAMICS RESEARCH
R.A. GROW, U.S. Air Force, Armament Laboratory, *Eglin Air Force Base, Florida* 32542 (DF643200)

This work unit will support store separation analysis. The major area to be addressed by this work unit is the analytical prediction of aerodynamic forces under transonic conditions. The purpose of this work unit is to perform in-house transonic aerodynamic research to increase the AFATL/DLJC capability for analyzing store separation aerodynamics in transonic flight regimes. The technique developed by this work unit will decrease the cost of determining store/aircraft compatibility.

The principal investigator shall perform studies and theoretical investigation to identify the state-of-the-art of transonic aerodynamics and store separation analysis. He shall plan, coordinate, and monitor wind tunnel tests to verify the analytical techniques identified through the state-of-the-art investigation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

1.0011, AIRCRAFT/WEAPON SEPARATION ANALYSIS
A.V. MARRIN, U.S. Air Force, Armament Laboratory, *Eglin Air Force Base, Florida* 32542 (DF626640)

To establish a feasible semi-empirical method by which good approximations of weapon separation trajectories from high-performance parent aircraft can be predicted. The method will be used to establish weapon design criteria in support of weapon development programs and to predict weapon separation trajectories prior to wind tunnel and flight testing.

The wind tunnel will be used to collect downwash and sidewash velocity data in the immediate vicinity of the external weapon stations of various aircraft models. These data will be used to calculate the total body coefficients and thus the forces and moments, given the weapon position and orientation. The equations of motion governing six degree of freedom displacement of the weapon are then used to calculate a point-to-point trajectory.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

1.0012, AN INVESTIGATION OF STRESS-STRAIN HISTORY MODELING AT STRESS RISERS
J. CARROLL, Lockheed Georgia Company, *Marietta, Georgia* 30060 (DF134900; F33615-75-C-3078)

The occurrences of fatigue cracks in tactical and strategic aircraft structures degrade structure strength, increase life cycle costs and impair fleet readiness. This program will be directed to development of a model to depict the stress-strain behavior that occurs at stress risers in aircraft structures. The development of an accurate model is essential for assessing fatigue crack initiation and to enable the design of future structures to resist crack initiation.

An experimental and analytical effort to model stress-strain behavior at stress risers is to be conducted in two phases. Phase I effort will investigate the adequacy of the selected experimental techniques and existence of meaningful variations in plastic strains at stress risers. Phase II effort, to be undertaken if phase I is successfully completed, will include the collection of a data base and the development of a stress-strain behavior model at stress risers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0013, DEVELOPMENT OF THE OPTICAL CONVOLUTION VELOCIMETER
M.J. RUDD, Bolt Beranek & Newman Inc., *Cambridge, Massachusetts* 02138 (DF136720; F33615-76-C-3051)

Current airspeed indicating systems for military aircraft are accurate to a minimum speed indication of 50 knots (approx). Present sensing system errors in the low speed range are signifi-

cant and are of sufficient magnitude to cause safety of flight problems when hovering or approach to landing for V/STOL vehicles. The objective of this study is to further develop the optical convolution velocimeter, examine operational suitability and equipment environmental requirements, and test the device. The device is to be capable for accurate sensing and displaying of airspeed in the range of V/STOL-type aircraft.

The Air Force Flight Dynamics Laboratory has been developing various time-of-flight sensing techniques for velocity measurement. Of particular promise on the effort is the optical convolution velocimeter. This device has been submitted in an AF patent disclosure and presented at the Laser Doppler Workshop at Purdue University in Mar 74. Dr. M. Rudd of BB&N has developed appropriate theory for single sensor detector, and has designed, fabricated, and tested a prototype unit. The approach is to proceed with further development with a) improvements in optics design, signal processing circuitry, b) characterize the spectral response of the device, c) examine environmental requirements for such a device, and d) test and evaluate. This approach has been suggested in an unsolicited proposal by Bolt, Beranek and Newman, Inc., of Cambridge, ma.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0014, FINITE-ELEMENT ANALYSIS OF CREEP AND THREE-DIMENSIONAL FRACTURE

T.H. PIAN, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (DF048350; F49620-77-C-0084)

AF function - advanced flight vehicle structures and engine structures require improved design methods which accurately consider environmental conditions. Deficiency - accurate and efficient structural analysis methods do not exist which consider elevated temperature creep response. Objective - this research will investigate the propagation of structural defects under creep conditions. How work contributes -research will improve engine durability predictions.

This research will study the extension of hybrid finite-element methods for crack analysis to include creep phenomena. Crack extension studies will investigate the stress distribution and stress time histories at the crack front. Special elements will be developed to model correct stress singularity under creep conditions. Predictions of crack growth will be compared with experimental data found in the literature. In addition six problems will be solved which involve the prediction of stress intensity factors governed by three-dimensional behavior.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0015, AIRDROP SYSTEMS RIGGING TECHNIQUES

P. SHOPALOVICH, U.S. Army, Natick Research & Dev. Command, *Natick, Massachusetts* 01760 (DA0F4304)

Develop new, more efficient and less complex airdrop rigging procedures which will reduce the rigging manpower requirements and malfunction rates of airdrop to make it more competitive with movement by airlift (air land or helicopter delivery), thereby giving the unit commander an option when his mission calls for air movement of supplies, equipment and personnel.

Review present-day rigging procedures, proposing new, more efficient rigging procedures using existing or newly type classified airdrop components. Conduct time and motion studies. Conduct verification testing of the new rigging procedures. In addition, moment of inertia and roller forces for rigged airdrop loads will be obtained.

SUPPORTED BY U.S. Dept. of Defense, Army, Natick Research & Development Command

1.0016, STUDY OF THE DESIGN AND PERFORMANCE CHARACTERISTICS OF AIRCRAFT SIMULATORS

L.E. FOGARTY, Univ. of Michigan, School of Engineering, *Ann Arbor, Michigan* 48106 (DF047810; AF-AFOSR-3245-77)

AF function - specific means for improving simulation technology, taking into account problems of motion, visual and flight simulation, are needed to help optimize present and future air force simulation assets. Deficiency - specific recommendations for optimizing Air Force simulation performance characteristics are still lacking. Objective -current state-of-the-art motion system performance capabilities will be analyzed and specific recommendations will be concerning the relative improvements to be anticipated through additional engineering development efforts. How research contributes - greater training and cost effectiveness of Air Force simulators, including the ASUPT, through a systematic, in-depth and on-site review of current and planned simulation assets.

A result of 20 months of on-site in-depth study of the available and applicable technology, specific engineering development efforts to improve Air Force simulation assets will be made.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0017, ANALYSIS OF AIRPORT LIGHTING SYSTEMS

UNKNOWN, U.S. Navy, Air Engineering Center, *Lakehurst, New Jersey* 08733 (FA77WAI-786; FA160453 (TRAIS NO.))

This ER establishes the requirement for a review and analysis of available reports, theoretical studies, and test and evaluation reports to establish the criteria to determine the appropriate intensity settings of approach and runway lights to support landing operations in all visibility conditions, and develop data for lighting and marking problems associated with spatial disorientation and visual guidance.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0018, DESIGN OF LIGHTWEIGHT ARMOR SYSTEMS

C.D. DONALDSON, Aeronautical Res. Associates, *Princeton, New Jersey* 08540 (DF138820; F33615-76-C-3156)

This work unit supports the area of armor material development of aircraft application. Aircraft survivability can be greatly enhanced if critical subsystems on board the aircraft can be protected from impacting projectiles or fragments. Lightweight and low-cost armor design concepts, such as those to be investigated in this effort, could have a significant payoff for Air Force applications. It is the objective of this program to study the projectile penetration process and to identify, based on this, the most suitable armor material properties and to identify materials that exhibit such properties. The payoff can be greatly enhanced weapon system effectiveness in the hostile threat environment as well as reduced system acquisition cost.

Continue development of the integral theory of impact with emphasis on the application to the design of lightweight armor. The contractor will determine, based on experimental impact data, whether the heat of fusion of materials may be used to effectively design lightweight armor systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0019, INTEGRATED AUTOMATIC FLIGHT/FIRE CONTROL SYSTEMS (FIREFLY II)

R.A. BELL, General Electric Company, *Binghamton, New York* 13902 (DF135960; F33615-75-C-3143)

Improving the weapon delivery accuracy of tactical fighter aircraft is a critical problem which relates directly to combat effectiveness. The overall objective of this effort is to improve the delivery accuracy of conventional unguided air-to-air and air-to-ground weapons through integration of the aircraft's flight control and fire control systems. The technical objective of this study is to establish the desirability of integrated flight control/fire control systems by relating each proposed configuration to weapon accuracy. Another objective of the program is to establish the related technology base of flight/fire control systems. The results of this program will be directly applicable to current and future tactical fighter aircraft where improved weapon delivery accuracy will result in lower operating costs and reduced combat losses.

A variety of applicable techniques and configurations for interfacing the flight control and fire control systems will be defined and analyzed for a selected tactical fighter aircraft. Advanced

designs such as direct lift and direct side force will also be addressed. Comparative analysis of weapon delivery accuracy for the various automatic and manual systems will be included. Results of the analysis will be confirmed by a detailed piloted simulation effort which utilizes the flying qualities of each aircraft/flight control/fire control configuration.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0020, RESEARCH ON HELICOPTER ROTOR NOISE 12716-E

A.R. GEORGE, Cornell University, School of Engineering, *Ithaca, New York* 14850 (DA0F5572; DAHC04-75-G-0120)

To develop quantitative understanding of, and methods of analysis for, rotor noise due to random blade loadings and rotor noise due to thickness, acceleration and fluid stresses at high Mach numbers. Relevance - this research proposal will complement the AMRDL-Ames Directorate's research program in rotor blade research. It directly impacts on the current plans and the future direction of helicopter rotor blade noise work at AMRDL-Ames Directorate.

A theoretical analysis for high-speed blade slap noise will be carried out based on the Fowes Williams-Hawkings formulation. A comparative theoretical study of various sources of broadband noise will be made to determine the relative importance of various physical mechanisms which lead to random rotor blade loadings and, hence, to broadband noise.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

1.0021, LIGHTNING INDUCED VOLTAGES IN AIRCRAFT ELECTRICAL CIRCUITS, PHASE II

F.A. FISHER, General Electric Company, *Schenectady, New York* 12305 (DF138290; F33615-76-C-3122)

When lightning flash currents are conducted through an aircraft skin and/or structure between a pair of entry and exit points, changing magnetic fields are created within the airframe which link electrical cables and wires and induce transient voltages in them. It is desired to relate these induced voltages with lightning current and electrical circuit characteristics for analytical assessment of the vulnerability of flight control system circuitry to upset and/or damage. A preliminary model has been developed under AF contract F33615-74-C-3068. The objective of this effort is to expand these analytical models to more comprehensively examine the lightning/aerospace problem.

Review program with related programs developed by AFWL and Ukaea Culham Laboratory. Refine present aircraft configuration model to include more descriptive geometry, both internal and external. This includes radome, cable type, and location, etc. The model will also include changes in material such as composites and dielectrics. The program will have option of output as either time or frequency domain to make compatible with intra-systems analysis program (IAP). The final task will be a validation by comparison of experiment with analytical model results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0022, ADVANCED TURBINE ENGINE CONTROLS COMPONENTS

H.B. KAST, General Electric Company, *Cincinnati, Ohio* 45215 (DF456570; F33615-74-C-2007)

Under this program, a sensor and an interface development effort are taking place. The objective for the sensor development is to develop a high-temperature absolute magnetic shaft encoder (position sensor) and to demonstarte the functional and operational capability of the encoder within the turbine engine environment. The objective for the interface is to design, develop, and test an electrohydraulic servovalue with fail-fixed features.

Each component developed will be bench tested to demonstrate functional capability and engine tested to verify operational integrity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

1.0023, COMPARISON OF AIRCRAFT ACCIDENT DATA TO ALIGN DETAILED CAUSE/FACTOR ITEM WITH EXISTING AVIATION SAFETY PROGRAM

UNKNOWN, Battelle Memorial Institute, *Columbus, Ohio* 43201 (FA77WA-4072; FA160415 (TRAIS NO.))

Furnish data concerning FAA's overall program of activities and cite those which are thought to contribute directly to safety. A study of accident dockets for all air carrier accidents in the 1966 through 1975 time frame shall be undertaken. Development of a recommended expansion of the current NTSB cause/factor classifications, document all findings and provide the appropriate lexicon. Development of a methodology for evaluating current FAA safety program elements and various accident cause/factors, based on the frequency, severity, and cost of the type of accidents they precipitate.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0024, LIFE ANALYSIS AND DESIGN METHODS FOR AEROSPACE STRUCTURES

F.D. ADAMS, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF140470)

MIL-STD-1530A defines the overall requirements necessary to achieve structural integrity of USAF aircraft. MIL-A-83444 specifies applicable damage tolerance (safety) requirements and MIL-A-8866B identifies durability (economic life) requirements. The objective of this effort is to develop and verify analytical and experimental life analysis methods which can be used to satisfy the above requirements. These methods are needed to insure structural integrity of USAF aircraft and will result in increased safety and reduced life-cycle costs.

Employing engineering disciplines involving fatigue, fracture mechanics and reliability, methods of predicting the structural life will be developed and applied. Basic damage mechanisms will be investigated and appropriate analysis procedures developed. Specific tasks include: (1) analysis of load spectra to determine damaging components, (2) development of test and analysis spectra, (3) investigation of cycle counting procedures to determine how they influence damage prediction, (4) updating the cracks computer code as new or improved methods of predicting crack growth are developed, (5) studying load spectrum variations and sustained loading as to its influence on crack initiation, (6) investigation of the 'equivalent initial quality' method, (7) development of appropriate reliability procedures for application to structural integrity problems. In addition, existing and new life analysis procedures will be applied to aircraft design and fleet operations problems. Specific tasks include: (1) evaluation of the performance of currently available fatigue improvement fasteners, (2) determining the impact of the new damage tolerance spec, MIL-A-83444 on design, (3) preparation of a damage tolerance handbook, (4) investigating and devising tracking methods for fleet management.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0025, FLUID AND MECHANICAL POWER TECHNOLOGY DEMONSTRATION

K.E. BINNS, U.S. Air Force, Aeropropulsion Laboratory, *Dayton, Ohio* 45433 (DF458380)

To demonstrate new technology for potential aircraft users. Specific technology to be demonstrated will be 30,000 rpm vane pump, oscillating spool power transfer units and electrohydraulic digital actuators.

Prototype hardware delivered as result of AFAPL R&D contracts will be installed in laboratory systems and demonstrated to potential users. Tests of a 30,000 rpm vane pump will be conducted to verify its performance for use in future A/C hydraulic systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

1.0026, MOMENTUM AND ENERGY EXCHANGE IN MULTICOMPONENT EJECTOR PUMPING
S.H. HASINGER, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF136510)

Current high energy chemical laser systems are required to operate with very low laser cavity pressures and at the same time exhaust to ambient conditions. The pressure recovery required to accomplish this cannot be realized without some sort of external pumping system. At the present there is a lack of a flight-weight pumping system capable of meeting the requirements of an operational chemical laser. The objective of this research is to determine and demonstrate the feasibility of using gas-driven ejector pumping concepts to attain the high pressure recovery required by chemical laser systems. Ejector pumping concepts have the potential of providing a compact, lightweight pump for use with an airborne chemical laser system.

The basic aerodynamics of the relevant flow processes will be investigated experimentally and analytically to determine the applicability of these concepts for the chemical laser pumping application, and to define the ranges of possible operation. Additionally, an analysis of the overall pumping system configuration will be made to define energy, volume, and weight requirements for the system, and an attempt will be made to optimize the pumping cycles for minimum system weight. In order to do this it will be necessary to maximize the pressure recovery capability for a given mass flow of the ejector pumping fluid. It is anticipated that areas of research will include nozzle design, nozzle placement, mixing section configuration, and diffuser configuration.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0027, FLIGHT CONTROL SYSTEM DEVELOPMENT CRITERIA
T.D. LEWIS, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF138620)

Analysis tools to predict flight control/weapon system performance and cost estimates are inadequate to be applied early in the design cycle. Also, newly emerging flight control technologies require a firm data base and experience factors to be included in military specifications. The objectives of this effort are to (1) refine and consolidate the flight control system (FCS) development analysis, evaluation, and life-cycle cost (LCC) prediction techniques and (2) develop, refine, and revise military specifications for flight control system design, development, test, and evaluation. FCS specification revisions will incorporate newly emerging technology and aid in reducing FCS design and test time. Consolidation and refinement of analysis techniques will provide criteria for realistic system performance and cost estimates early in the design cycle.

Digital flight control system experience will be broadened through support of the A-7 digital multimode FCS test aircraft while in use at the test pilots school, through experience gained on the digital flight control system ADP, and through interaction with work on related programs performed by other agencies for application and incorporation into MIL-F-9490D. Development of a new specification for servo-actuators will continue. Review and update of MIL-V-27162, servovalve specification, will be initiated. Review, refinement, and consolidation of FCS analysis programs such as TAWDS, DIGIKIN, MPAS, and FCS LCC prediction will be conducted as applicable. Coordination with AFLC ALC's and the USAF Safety Center will be conducted along with review of FCS safety, survivability, reliability, and maintainability data to establish criteria for future FCS programs and specification update.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0028, EVALUATION OF METAL/GAS CELLS FOR AEROSPACE POWER SOURCES
I.F. LUKE, U.S. Air Force, Aeropropulsion Laboratory, *Dayton, Ohio* 45433 (DF456340)

To characterize the voltage, thermal and cycle-life performance of metal-gas (especially nickel-hydrogen) cells, constructed in-house and also developed under contractual programs. To provide in-house support to contractual hybrid (metal-gas) cell technology development programs.

Design and construct NiH2 cells in-house. Obtain contractually-supplied NiH2 cells of various designs. Evaluate these cells to determine their performance characteristics and cycle-life under various cycling profiles. Determine the thermal characteristics of lightweight cells under cycling load in a simulated space environment. Test thermal model NiH2 battery for proposed space flight experiment. Perform studies of metal gas technology applications and develop applicable computer models.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

1.0029, MILITARY AIRCRAFT VULNERABILITY TO ATMOSPHERIC ELECTRICITY
V.L. MANGOLD, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF132780)

Analytical and experimental efforts within the Air Force are needed to provide data for the protection of military aircraft to the effects of atmospheric electricity. This effort will establish technology for reducing the vulnerability of military aircraft to the natural environment associated with atmospheric electricity. The results of this program will have applications to commercial aircraft and space and ground vehicles.

Facilities and test techniques will be developed to assess the survivability and vulnerability (s/v) of aircraft systems to lightning strike and EMP effects. These facilities will be used to provide a data base of atmospheric electricity effects for development of design criteria and technology for s/v of military aircraft systems and subsystems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0030, CONTROL SYSTEM INDUCED AEROELASTIC INSTABILITIES
T.E. NOLL, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF134660)

Aircraft with active control systems can encounter instabilities which result from the interaction of the control system with the aeroelastic response if adequate control compensation is not provided. The objective of this effort is to substantiate analyses which account for the control system interaction. This effort will establish the confidence and reliability of AFFDL in-house analysis procedures. The ultimate payoff will be a reliable method for use in the design stage for predicting and preventing control-induced aeroelastic instabilities thus reducing cost and increasing flight safety for a new aircraft.

Frequency and time domain computer programs developed under AFFDL contract F33615-73-C-3063 will be applied to an advanced fighter aircraft with an active control system to predict control-induced aeroelastic instabilities. These analyses will involve the interaction of the structural response, the airloads, and the control system response. A final technical report will be prepared.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0031, AERODYNAMIC ANALYSIS METHODS FOR FLIGHT VEHICLES
D.E. SHEREDA, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF138390)

Determination of the aerodynamic characteristics of high-speed vehicles must be made early in the design development of such systems. Experimental test programs are expensive and limited in scope whereas numerical methods, while not having these problems, are accurate only within narrow limits of shape and speed. This effort seeks to expand these limits for vehicles suitable for high-speed flight, both aircraft and missiles. Numerical methods will be developed and evaluated for improving accuracy of analysis techniques.

Recently developed analysis methods will be exercised, evaluated and improved to provide increased analysis capability. New methods will be developed in areas of unsatisfactory correlations with test and flight data. An experimental program to provide

data on high-performance aircraft will be conducted in-house. Comparisons of these data with latest analysis methods will provide further insight into shortcomings of updated numerical techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0032, TURBINE ENGINE CONTROL SYSTEM DEVELOPMENT (IN-HOUSE)

L.L. SMALL, U.S. Air Force, Aeropropulsion Laboratory, *Dayton, Ohio* 45433 (DF451970)

The objective of this in-house effort is twofold--to develop, fabricate and test high-response turbine engine sensors so vitally necessary for advanced propulsion system control, and using this instrumentation as an input and a digital computer as processor, to develop and evaluate new control modes including optimal control techniques for the complex, multi-input and multi-output turbine engine control systems of the future.

The technical approach to this in-house effort consists of several interrelated tasks: (1) development of an analog and digital data acquisition/reduction capability for an engine test cell, (2) development, fabrication, and experimental evaluation of high-response gas turbine engine sensors for possible control system applications, (3) analysis of various digital J-85 engine models and updating of these models from actual engine test data, (4) evaluation of classical control schemes with emphasis on closed-loop control of unique engine parameters such as compressor discharge corrected airflow and turbine inlet gas temperature, and (5) the evaluation of modern control theory (i.e., using the state variable plant representation) as applied to actual engine control.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

1.0033, INVESTIGATION OF TACTICAL FIGHTER FOREBODY FLOW FIELD AND INTEGRATED INLET PERFORMANCE DATA

L.E. SURBER, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF131210)

One of the critical problems in preliminary aircraft design is the deficiency of technology in the area of airframe-propulsion integration. This program seeks to provide a broader range of fundamental design criteria for supersonic external compression air inlets, thus providing the means to reduce development cost of future propulsion system installations. The objective of this program is to provide the capability to design an aircrafft air intake from the outset which will combine simplicity, high performance, and reliability to such a degree that the necessity for subsequent cycles of test and redesign will be significantly reduced or eliminated.

In-depth investigation of wind tunnel data generated under F33657-69-C-1209, F33615-72-C-1747, and F33615-72-C-1160 will be accomplished. This effort will include examination of forebody flowfields, inlet diverter flow, inlet face total pressure distribution, duct total and static pressure distributions, compressor face pressure recovery and distortion, and inlet/airframe drag data. Both steady-state and dynamic data will be used to determine sources of flow distortion. Effects of inlet design variation on inlet-related drag will be examined. The associated effects of various inlet designs and installations will be used to suggest design improvements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0034, HIGH-TEMPERATURE HEAT TRANSFER TEST PROGRAM

J.A. VONADA, U.S. Air Force, Aeropropulsion Laboratory, *Dayton, Ohio* 45433 (DF460310)

A) To test, analyze and evaluate hot section components for advanced turbopropulsion applications. Typical applications include evaluation of high-temperature turbine vane/blade cooling schemes and testing of advanced materials and coatings. B) To analyze high gas and material surface temperature measurement concepts.

In the initial facility application, turbine vane cooling concepts are evaluated by mapping thermal contours of the vanes using infrared techniques. A color data pyrometer observes vane temperature while the desired test conditions are varied. An IBM 1800 computer is used for data acquisition. Temperature and pressure measurement concepts are evaluated during vane tests.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

1.0035, METHODOLOGY FOR SURVIVABILITY IN PRELIMINARY DESIGN

D.M. REEDY, Ling Temco Vought Incorporated, *Dallas, Texas* (DF137090; F33615-76-C-3092)

The objective of this effort is to develop a methodology which can rapidly assess, integrate, and optimize survivability, consistent with available detail, in the preliminary design phases of prototype aircraft. Presently, there is no known quantitative methodology which can determine optimum survivability within the desired constraint of an optimally designed aircraft. Development of the methodology will allow aircraft to be designed such that many factors, including total life cycle costs, are optimized. The major benefit will be in the elimination of non-optimal aircraft retrofits which plague the current state-of-the-art.

This effort will consist of two tasks. Task I will be a survey/assessment of current state-of-the-art of methodologies which are applicable to the preliminary design process. Also, the preliminary design process will be defined to determine at what point in design survivability may be included for beneficial results. Task II will consist of the development of the methodology which will incorporate survivability in an optimum manner in the design process. The result of this task will be a set of monographs or charts which the designer may use to rapidly assess survivability features pertinent in preliminary design. The methodology will then be applied to an existing aircraft.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0036, HYDRAZINE FUELED APU STARTER

L. GALBRAITH, Rocket Research Corporation, *Redmond, Washington* 98052 (DF459530; F33615-76-C-2148)

To develop a hydrazine fueled system to start gas turbine auxiliary power units (APU). This APU starter is expected to provide a true minus 65 degrees F start capability for aircraft APUs.

To minimize the cost of this effort only concept feasibility will be demonstrated. The first phase of this effort covered with the 55K of LDF will provide the system design. The remainder of the program will be used to develop and demonstrate the key components.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

1.0037, SUPERSONIC WING-BODY ANALYSIS AND DESIGN

P.E. RUBBERT, Boeing Company, *Seattle, Washington* 98108 (DF139590; F33615-77-C-3051)

This work will be in support of designing and analyzing fighter aircraft becoming operational in the 1985 time frame. Many of these aircraft have geometrical shapes that present considerable difficulty in estimating aerodynamic properties. This includes calculations of the flow in and around the region of the engine inlet and over a highly blended wing/fuselage/inlet shape typical of advanced supersonic fighters. This effort will allow the aerodynamic properties of a vehicle to be estimated without running tunnel tests on impractical shapes. This will represent a substantial cost saving to the Air Force and will result in a computer program capable of computing the flow over highly complex aircraft shapes at supersonic speeds.

An advanced paneling method will be used to describe the aircraft to a computer program. This technique can be used to calculate the three-dimensional flow field about a complete aircraft. It is also amenable to the computation of internal flows such as ducts, inlets, and wind tunnels. This method will make use of source and doublet panels as the basic building blocks for

geometrically describing the aircraft configuration. Output data would consist of pressures and velocities at all boundary points, three-component forces and moments, and streamlines both on the aircraft and in the flow field.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, ORBITAL PHOTOGRAMMETRIC TRIANGULATION WITH TRANSLATIONAL AND ROTATIONAL DYNAMICAL CONSTRAINTS 13794

J.L. JUNKINS, Univ. of Virginia, School of Engin. & Appl. Sci., *Charlottesville, Virginia* 22903 (DA0E9282; DAAG29 77 G0018)

To develop improved methods for orbital phalogrammetric triangulation which has a potential for resulting in improved prediction aspects of the orientation of the spacecraft. Relevance - accurate mapping and point positioning have obvious relevance to a variety of military activities. The planned work shows promise of contributing to a better capability for controlling photogrammetric procedure from spacecraft. Engineer topographic laboratories and Defense Mapping Agency scientists have attested to the relevance of the proposal.

Methods will be developed to reduce the number of unknown parameters and thus simplify the consideration of the translationally and rotationally constrained variables of a camera in space. The central new idea is that the rotational motion of the camera (spacecraft fixed) must be a rigorous solution of the spacecrafts' rotational equations of motion.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, LOW SIGNATURE PROPULSION

W.W. WHARTON, U.S. Army, Radar Technology Laboratory, *Huntsville, Alabama* 35809 (DA0F1340)

To develop and evaluate propellants with low signature capability and with improved properties such as longer service life, wider burning rate ranges, improved physical properties, and lower cost.

The investigation of the use of lower cost RDX replacement of HMX and nitroglycerin in cross-linked double base and composite propellants will be pursued. Investigation of new binders and oxidizers will be pursued. The signature characterization facility will be used to characterize and evaluate smokeless propellants.

ADDENDA: Supporting agency address is: MIRADCOM Propulsion Directorate, Technology Laboratory, Redstone Arsenal, AL 35809

SUPPORTED BY U.S. Dept. of Defense, Army

3.0002, EXPERIMENTAL STUDIES OF THE STATE-TO-STATE CHEMICAL DYNAMICS OF REACTIONS INVOLVING AIR TRIATOMICS

R.J. MCNEAL, Univ. of Southern California, Graduate School, *Los Angeles, California* 90007 (DF048970; AF-AFOSR-3348-77)

AF function - Air Force operations in communications, surveillance and detection require knowledge of atomic and molecular phenomena that can produce IR radiation in the disturbed atmosphere. Deficiency - an understanding of the detailed emissive properties of the disturbed atmosphere that are required in IR radiation calculations. Radiations from the normal and disturbed upper atmosphere can constitute significant background for optical surveillance mission sensors. Objective - study experimentally the state-to-state chemical dynamics of reactions of atoms and diatomic molecules that occur along potential energy surfaces of air triatomics. How work contributes - provides data useful for calculations of IR radiation from the disturbed atmosphere. These data will also provide sensitive tests of the accuracy of theoretical calculations of reaction dynamics for these important chemical systems.

Using flowing afterglow techniques and state-of-the-art techniques for detection of NO study the formation of vibrationally excited NO in the reaction of electronically-excited N and O2. Study the quenching of vibrationally-excited NO by atomic oxygen. Correlate experimental results with theoretical studies where appropriate. The data to be obtained will be immediately applicable to calculations of IR radiation from the disturbed atmosphere, and will also be useful as benchmarks for testing of future theoretical calculations of the collision dynamics based upon accurate potential energy surfaces for NO2. Extension of the experimental techniques to other reaction and collision processes involving air triatomics as intermediates is proposed for future research.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NC Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

3.0003, A THEORETICAL MODEL OF THE EFFECT OF TEMPERATURE ON THE LIMITING OXYGEN INDEX OF POLYMERIC MATERIALS

A.C. LING, Calif. State Univ. & Colleges, School of Science, *San Jose, California* 95114 (NSG 2302)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0004, MATERIALS SUPPORT TECHNOLOGY - PARTICLE IMPACT DAMAGE AND EROSION OF CARBON-CARBON AND CERAMIC COMPOSITES

A.G. EVANS, Rockwell International Corp., *Thousand Oaks, California* 91320 (DN675495; N00014-76-C-0854)

Carbon-carbon composites (C/C) are prime candidates for use in RV nose cones and launch vehicle rocket nozzles. Material removal by erosion is a serious problem in the RV case, and may be of importance for nozzles. Attainment of materials with microstructures which optimize resistance to erosive removal is crucial. This necessary development of suitable microstructures requires identification of materials variables which exert strong influences on materials removal. This identification is not yet available in terms of detailed relationships between material removal rate, target properties and microstructure, and the projectile properties. This is the goal of this task.

Analyses of kinking and fracture (via instrumented weight impacts) pertaining to impact damage observed in carbon-carbon composites are being performed. Relations between extent of kinking and fracture with impact stresses are being obtained. Projectile impact test on carbon-carbon composites will be correlated with microstructures. The damage resistance of pan- and pitch-based materials will be compared with microstructural features of each. The experiments will be evaluated from 0 to 3600 C, 1800 to 5500 M per S. Rayon-based materials will also be investigated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0005, MECHANICAL BEHAVIOR OF AIRFRAME MATERIALS

N.E. PATON, Rockwell International Corp., *Thousand Oaks, California* 91320 (DF042380; F44620-76-C-0025)

AF function - titanium and its alloys have been of considerable interest to the AF because of very favorable strength-to-weight characteristics at temperatures from cryogenic up to 800 degrees F, and resistance to attack by many chemicals. Potential applications for skins, structural and engine components of high-

performance aircraft, cryogenic fuel storage tanks for missiles, and tubing for transporting corrosive fuels all emphasize the available materials roles for titanium alloys. Opportunity - despite improvements in processing techniques, all commercial titanium products contain residual hydrogen which can, under certain conditions, influence their mechanical behavior. The effects of such residual hydrogen on the properties of titanium are of primary importance from a practical point of view, but these effects are incompletely understood in the more complex commercial alloys. Consequently, hydrogen is often overlooked as the cause of variability in the mechanical behavior of these alloys. Objective - this research will determine the influence of hydrogen on mechanical properties such as loss of ductility, decrease in fracture toughness, increase in creep rate, and increase in both sustained load and fatigue crack growth rates. How work contributes - the mechanisms by which internal hydrogen influences these and other mechanical properties are not well understood.

A systematic study of the effect of hydrogen content and aluminum content on the stress field around hydrides, and an investigation of tensile, creep, fatigue and sustained load cracking properties of Ti-Al and Ti-Sn specimens, with and without notches, and over a range of temperatures, will be carried out.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0006, DETECTION OF MATRIX STRESSES IN GRAPHITE-EPOXY COMPOSITES

P.K. PREDECKI, Univ. of Denver, School of Engineering, *Denver, Colorado* 80210 (DF048180; AF-AFOSR-3284-77)

AF function - the function of nondestructive evaluation (NDE) in the Air Force is to save lives and resources through timely examination of aircraft and engine components to assure their continued safe operation. Deficiency - many inspection techniques have been developed for metals; however, despite the increasing use of polymer composites, there has not been an adequate development of NDE techniques for these materials. Objective - the objective of this work unit is to conduct research on the detection of matrix stresses in graphite-epoxy composites by NDE techniques. How work contributes - matrix stresses are indicative of the soundness of the composite and indicate degradation such as debonding, fiber breakage, and humidity infiltration.

A new application of X-ray stress analysis for detecting residual and applied stresses in the matrix of graphite-epoxy composites will be investigated. The method makes use of small amounts (less than 20 wt percent) of crystalline filler placed in the matrix of any desired ply or plies during the fabrication process.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0007, MOLECULAR CRYSTAL CHEMISTRY

E.R. BERNSTEIN, Colorado State University, School of Natural Sciences, *Fort Collins, Colorado* 80523 (DF048720; AF-AFOSR-3317-77)

AF function - future Air Force weapons and avionics systems will require low-cost, high-purity electromagnetic materials with unique electronic and electro-optical properties. Deficiency - the molecular crystal chemistry which is essential for predicting electromagnetic materials properties has not been established. Objective - the object of this research is to develop the characterization and understanding of cooperative solid-state phenomena in organic and inorganic molecular crystals. How work contributes - it is expected that this research will contribute to the development of new methods in crystal chemistry for predicting new organic and inorganic chemical structures with ferroelectric electrooptical and solid-state electronic and magnetic properties.

Experiments will be conducted to identify and relate soft modes, lattice instabilities and structural, magnetic and electrical phase transitions in molecular crystals. The interaction of electromagnetic radiation and dipolar lattice and molecular modes in molecular solids, including ferroelectric and ferroelastic materials, will be investigated. Research will be conducted to establish the existence or nonexistence of polaritrons in molecular solid-state chemistry and dynamic behavior.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NC, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

3.0008, CHEMICAL KINETICS

M.C. LIN, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN480193)

To develop a better understanding of the kinetics and mechanisms of elementary chemical processes which are of basic importance to chemical lasers, fire suppression, combustion, rocket propulsion and related subjects of interest to the Navy.

The kinetics and mechanisms of exothermic reactions, involving a variety of reactive species such as atoms and free radicals of importance to lasers, combustion and flame systems, are systematically studied. Flash photolysis, electrical and microwave discharges, laser excitation and other conventional kinetic methods are used. Emphasis is also placed on the generation of stimulated emission over a wide spectral range (IR, visible, UV and/or vacuum UV). In addition, the effects of laser excitation on the course and rate of a chemical reaction are investigated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

3.0009, NAVY VEHICLE DESIGN AND CONSTRUCTION - DEFORMATION AND FATIGUE IN BETA TITANIUM ALLOYS

E.A. STARKE, Georgia Inst. of Technology, School of Chemical Engineering, *Atlanta, Georgia* 30332 (DN123525; N00014-75-C-0349)

Beta titanium alloys are seeing increased use in aircraft because of their many desirable properties--light weight, good strength and ductility, and corrosion resistance. This project will develop needed information on the mechanical properties of new beta titanium alloys that show promise of excellent formability and toughness.

A series of strain-controlled low-cycle fatigue tests will be conducted to determine the cyclic stress-strain response of four Ti-V alloys heat-treated to produce various microstructures having different deformation modes. The change in flow stress with cycles, and the hysteresis loop energy and shape will be monitored to determine the degree of cyclic hardening, softening, and slip reversibility. Microstructural effects on crack initiation and propagation in the fatigue specimens will be studied using fractography. The data obtained from monotonic and fatigue testing will be correlated with the Microstructural features and deformation modes of the various materials to establish their relationships.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0010, THE INFLUENCE OF THERMAL-MECHANICAL TREATMENTS ON THE FRACTURE OF POLYMERS 12710

L.J. BROUTMAN, Illinois Inst. of Technology, School of Engin. & Phys. Sci., *Chicago, Illinois* 60616 (DA0N5570; DAAG29 77 G0160)

To conduct a quantitative study of the effects of residual stresses upon toughness and fracture behavior of glassy amorphous polymers such as polycarbonates and polymethylmethacrylate. The role of residual stresses in stress cracking will also be addressed. Relevance - the proposed research is relevant to Army problems in transparent armor (for aircraft and personnel protection) and in the processing of many hardware components molded of glassy polymers.

Residual stresses will be introduced into polymer sheets by thermal quenching and/or mechanical deformation. The three-dimensional stress states will be measured by ultrasonic wave techniques. The latter, together with optical birefringence studies and stress analysis methods, will be employed to distinguish between elastic locked-in stresses and the residual molecular orientation due to flow of the polymers. The effects of the various residual stress states on the physical properties of the polymers will be determined, with consideration to stress relaxation.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0011, GAS-SURFACE DYNAMICS

L. WHARTON, Univ. of Chicago, Graduate School, *Chicago, Illinois* 60637 (DF046930; AF-AFOSR-3186-77)

AF function - materials of construction for advanced Air Force systems will be required to resist a variety of hostile environments, such as, radiation from the sun, lasers and nuclear explosions. Deficiency - materials whose useful properties have been degraded by exposure to hostile environments, e.g., radiation, can fail catastrophically and thereby adversely affect the survivability of AF weapon systems. Objective - to understand the causes of susceptibility of surfaces to laser damage and to determine how such damage can be minimized. How work contributes - information gained from this research will be used to develop new materials and protect existing ones from the deleterious effects of hostile radiation.

The fundamental processes of gas-surface dynamics will be investigated using laser radiation to rapidly raise the temperature of various substrate materials, e.g., nickel, copper, silver. Under these conditions the exact mechanisms of desorption processes from these surfaces can be precisely determined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0012, INITIATION, COMBUSTION AND TRANSITION TO DETONATION IN HOMOGENEOUS AND HETEROGENEOUS REACTIVE MIXTURES

R.A. STREHLOW, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (DF049180; AF-AFOSR-3336-77)

AF function - advanced chemical explosive weapons, weapon delivery and defense, close-air support. Deficiency - insufficient understanding of basic chemical kinetic and gas dynamic processes associated with chemical initiation and transition to detonation in unconfined fuel-air clouds, lack of realistic guidelines for predicting detonation initiation, properties, scaling laws and blast potentials, and of data for evaluating feasibility of chemically initiated (single event) FAE III concept, and for evaluating vulnerability of aircraft components to flames, blast and detonation waves. Objective - to obtain better understanding and realistically model basic mechanisms responsible for chemical initiation and subsequent transition and propagation and attenuation of unconfined fuel-air explosions and non-ideal blast waves in reactive media. How work contributes - will provide (1) additional fundamental understanding of processes of chemical initiation of detonations, transition from deflagration to detonation and attenuation and quenching of flames, blast and detonation waves, (2) quantitative models not now available for a priori predicting properties and blast initiation requirements of unconfined fuel-air explosions, their scaling laws and blast damage potential of FAE clouds, (3) data for evaluating feasibility of chemical initiated detonation concept for application to advanced (single event - FAE III) explosive devices, guidelines for evaluating effective flame and detonation arrestors.

Initiation of detonation by nonlinear finite-amplitude waves will be studied using rapid response pressure gases, optical and smoke track techniques in fuels of interest to the Air Force behind the reflected shock in a preheated, incipiently explosive region. Theoretical models for the initiation process will be formulated based on these results and compared with those of existing models. Concurrently the process of detonation initiation as triggered by local concentrations of reactive chemical promoters will be studied using an existing LaGrangian time-dependent finite-difference program which calculates planar, cylindrical or spherical geometries. The effect of promoter concentration gradients on transition will be studied. These results will be presented such that optimum ratios of vapor cloud size to promoter spot size and optimum internal gradients are determined which promote transition from adiabatic explosion to detonation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0013, EFFECTS OF MISALIGNMENT ON MECHANICAL BEHAVIOR OF METALS IN CREEP

H.C. WU, Univ. of Iowa, School of Engineering, *Iowa City, Iowa* 52240 (NSG 1499)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0014, DYNAMIC INELASTIC BEHAVIOR OF MATERIALS

S.R. BODNER, Israel Inst. of Technology, *Haifa, Israel* (DF037730; AF-AFOSR-2607-74)

AF function - to contribute to a better understanding of problems involving structures and structural dynamics for all flight systems and their components. Deficiency - more efficient use of materials in flight systems structural design will result if more is known about the problems of dynamic inelastic behavior for materials. Objective - this research is devoted to the goal of developing the constitutive equations of mechanics to better represent real dynamic inelastic material behavior problems. How work contributes - an advancement in knowledge about why materials offer difficulty in cases of hardening, creep, stress relaxation, nonlinear flow, residual stress effects and ballistic impact will surely improve Air Force flight systems and their components.

Theoretical analyses of data already developed will be used to refine the constitutive equations for all areas of research except penetration mechanics - here both experimental and analytical investigations will be applied to the problem of impact resistance of layered target plates.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0015, FLOW LEADING TO FRACTURE

P.P. GILLIS, Univ. of Kentucky, School of Engineering, *Lexington, Kentucky* 40506 (DF049330; AF-AFOSR-3379-77)

AF function - aerospace vehicles require an improved understanding of fracture and flow leading to fracture so that designs of enhanced durability can be achieved. Deficiency - current design methods are based on technological results that are empirical in nature and without definitive theory. The theory of flow leading to fracture is quite controversial and a detailed scientific arbitrage is both timely and worthwhile. Objective - the principal goal of this research consists of a critical review of the conflicting theories to determine precise differences for the best probability of conformance with reality. In particular, this research will investigate the strain-rate effects on plastic instabilities and attempt to sort out important distinctions between the theories of Hart, Budiansky, Ghosh and Demeri. How work contributes - the payoff here lies in the area of enhanced workability for metals and their alloys. If the plastic flow that leads to structural instability and fracture can be improved, then malleability or ductility will also improve. This is to say that, as the strain rate sensitivity decreases, the strain hardening response improves to allow higher yields in deeper draws or deformation for all ductile alloys.

In the main, this research program is composed of three parts, viz. (1) review of the existing controversial theories, (2) three-dimensional numerical computations to evaluate stress triaxialities beyond the point of instability and (3) validation of theory and practice through actual experimentation with thin sheet and bar.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0016, ENERGY LEVELS OF OXIDES

R.W. FIELD, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (DF248680; F19628-77-C-0061)

AF function - nuclear weapons effects. Intercept weapon delivery. Deficiency - radar and communication blackout and optical interference following nuclear detonations cannot be accurately predicted. Objective - determine the energy levels and radiative lifetimes of lowest lying states of metal oxides in order to determine their importance in nuclear weapons effects. How research contributes - experimental data for energies of excitation and lifetime of states can be used in USAF codes to determine the importance of these considerations.

Optical-optical double resonance techniques will be used to study the electronic spectra of metal oxides. These techniques make it possible to identify the symmetry and to obtain spectroscopic constants for the ground and low-lying electronic states of metal oxides. Radiative lifetimes and predissociation rates will be measured as well.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

3.0017, NEW LASERS BASED ON COMPLEXES OF TRANSITION METALS

A. LEMPICKI, General Tel. & Elec. Corp., *Waltham, Massachusetts* 02154 (DF046290; F49620-77-C-0015)

AF function - this program is concerned with the development of an entirely new class of visible lasers which should represent a significant advance in coherent light sources. In Air Force applications, the ability to rapidly tune the wavelength of short, high-energy pulses would be a distinct advantage in many countermeasure, ranging and guidance applications. Deficiency - for these kind of avionics applications, ordinary dye lasers often fall short of the required energy per pulse and average power. Objective - the objective of this work is to develop materials and technology which will result in tunable systems having many of the advantages and properties of dye lasers but which would have superior energy storage capability, offer the possibility of q-switching, and which could be pumped with much higher energy light sources without the extremely short flash duration requirement of dyes. Contributions - some of the complexes of transition metals emit light with lifetimes, line width and extinction coefficients which are intermediate between the dyes and the rare-earth liquid lasers. These complexes bring a new dimension to optically pumped lasers whether solid or liquid.

The single property which is most significant for the operation of dye lasers is the short radiative lifetime (in the nanosecond regime) of the fluorescence process. It is this short lifetime which is responsible for the high gain but which at the same time represents a limitation where energy storage is important. The key problem is to find materials with longer radiative lifetimes, but line widths and yields comparable to dyes. Materials exhibiting strong phosphorescence are of limited interest due to the combined effect of broad line width and long lifetime on the laser threshold. The complexes of transition metals offer an alternative which is the thrust of this research. In particular, the porphyrins of transition metals are promising materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0018, THERMAL FATIGUE BEHAVIOR OF CERAMICS FOR TURBINE APPLICATIONS

G.D. QUINN, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0F4737)

The use of ceramics in gas turbines requires a firm data base with respect to thermal shock and thermal fatigue behavior. Many recently developed ceramics have shown promise in resisting thermal shock; however, their performance with repeated shocking (thermal fatigue) is uncertain. The objective of this program is, therefore, to evaluate the significant variables affecting the thermal shock, fatigue resistance of ceramics and to test various turbine material candidates for their behavior in this respect. Pacing materials problem addressed -thermophysical behavior of combustor materials - aircraft. Thrust - cost reduction.

Two thermal shock fatigue testers have been constructed and will be used to cycle ceramic test specimens through repeated thermal shocks. The heat-up and cool-down cycles will approximize the thermal environment experienced in gas turbine operating at 2500 degrees F TIT. Following testing, mechanical properties will be studied. Materials to be tested include: a. Hot-pressed silicon nitrides with varying additives (m sub g o, y sub 2 o sub 3) and various surface conditions. b. Reaction-bonded silicon nitrides with varying densities and surface conditions. c. Hot-pressed and reaction-sintered silicon carbides and sialons.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0019, ELECTRONIC STRUCTURE NEAR IMPURITIES IN DILUTE ALLOYS

P.L. SAGALYN, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0F4808)

To interpret the measured electric field gradients (EFG's) in terms of the induction electron screening cloud and lattice distortion around impurity atoms, and with particular reference to aluminum-based alloys. To enhance our understanding of purity interactions, as a means of predicting properties of new and improved alloys.

Calculations for aluminum atoms, which are 1st and 2nd neighbors to impurities, will be made by adding the tensor components of the EFG's which result from induction electron screening (valence effect) and the local lattice distortion (size effect), in accordance with a new theory of the co-investigators. Calculations of scattering phase shifts will be performed to determine input parameters for the valence effect. The magnitude of the EFG, the asymmetry parameter, and the direction of the main principal axis of the EFG will be calculated. If time permits, analogous work on Cu alloys with transition-metal impurities will be begun. The relevance of xa calculations to the EFG will be examined.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0020, NAVY VEHICLE DESIGN AND CONTRUCTION - STRENGTHENING MECHANISMS IN BETA TITANIUM ALLOYS

D.A. KOSS, Michigan Technological Univ., School of Engineering, *Houghton, Michigan* 49931 (DN223465; N00014-76-C-0037)

The high strength-to-weight ratio of titanium alloys makes them highly desirable for use in aircraft and submarine structures. This research effort will examine ways to increase the strength and toughness of titanium alloys.

Fatigue pre-cracked specimens of Ti-8Al-1Mo-1V will be fractured. The critical strain energy rate and/or stress intensity will be measured as a function of alpha-beta colony and alpha-phase orientation to the stress axis. Crack plane and fracture mode will be determined.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0021, EFFECTS OF SHOCK LOADING VARIABLES ON SHOCK-WAVE STRENGTHENING OF METALS 13183-MS

D.E. MIKKOLA, Michigan Technological Univ., School of Engineering, *Houghton, Michigan* 49931 (DA0T5573; DAAG29 76 G0054)

To determine the effects of shock loading variables upon the microstructure and properties of materials and to make a detailed comparison of laser-induced shock wave effects with those associated with mechanically introduced shock waves. Relevance - the proposed research has relevancy to hypervelocity impact research on projectiles and armor, and to the laser effects on materials as described in the Army's laser-hardened materials and structures plan (1974).

Detailed studies will be made of the microstructural and substructural effects caused by changes in pulse duration during shock loading of metallic alloys, a quantitative examination of the relationship between structure and properties of shock-loaded materials, and will include studies of how various time-dependent flow mechanisms partake in the deformation process. Both laser shocking and mechanical shocking studies would be performed.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0022, STRUCTURE OF DISPERSED LYOTROPIC LIQUID CRYSTALLINE PHASES

S. FRIBERG, Univ. of Missouri, School of Arts & Sciences, *Rolla, Missouri* 65401 (DMR76-23569)

Lyotropic liquid crystals have been shown to have a pronounced influence on the stability of disperse systems such as emulsions and foams. The first report on this effect was published less than ten years ago, but the phenomenon has already been applied in technical developments within different areas, such as the pharmaceutical and food technology industries and for the dispersion of essential components in a variety of commodities, such as those used in the production of concrete and the application of paper coatings.

The objective of the program is a basic understanding of those factors that determine the adherence of a dispersed liquid crystal to an interface. The determinations include: (1) size distribution by optical and electron microscopy, viscosity, and light scattering; (2) the electric surface potential of dispersed, liquid crystalline particles by zeta-potential measurements; (3) comparison between the microscopic structure of the liquid crystal in bulk and in a dispersed state by low-angle X-ray diffraction and electron microscopy; and (4) interfacial tension measurements using the sessile drop method. Results from 3 and 4 are used to evaluate the influence of the anisotropic conditions at an interface on the geometric dimensions of the liquid crystalline structure. The evaluation is made from calculations of the Van der Waals pressure by using methods developed by Parsegian and collaborators. The results of these investigations will form the basis for establishing rules for the adherence of liquid crystals to interfaces. The application of these rules to technical problems within different industrial activities will take place in collaboration with the engineering departments and with industry.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

3.0023, DIFFUSION AND TRANSFORMATION MICROMECHANISMS FOR SUPPRESSION DAMAGE AND FAILURE IN HIGH-STRAIN RATE DEFORMATION 13624-MSX

V.A. GREENHUT, Rutgers The State University, School of Engineering, *New Brunswick, New Jersey* 08903 (DA0Z5570; DAAG29 76 G0281)

To study (a) whether bulk diffusion in metallic alloys has a major role in deformation and fracture under shock loading and whether alteration of such phenomenon can be used to control shock response, and (b) whether transformations such as polymorphism, massive transformations, and shape-memory transformations can control high strain rate deformation and fracture. The research is relevant to Army needs in shock-loading, fragmentation, and ballistic penetration of materials.

To produce, evaluate, and characterize such alloys as A1-Cu, A1-Zn, and Fe-C alloys in A, and grey yields white Sn, Cd-Au, Cu-Zn, Ni-Ti, Au-Mu alloys in B prior to shock loading. Various microstructures are to be developed in the test samples and these in turn will be tested over a range of shock-loading variables at the BRL. The shock-loaded samples will then be examined by the proposer to evaluate the effects of the proposed mechanisms, bulk diffusion and phase transformations, on shock-induced failure and response to rapid deformation.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0024, OXIDATION KINETICS OF HYDROCARBON FUELS

I. GLASSMAN, Princeton University, School of Engin. & Appl. Sci., *Princeton, New Jersey* 08540 (DF001830; AF-AFOSR-2604-74)

AF function - weapons delivery, air support, airlift. Deficiency -accurate modeling of combustion and exhaust plume processes in present and future aircraft engines requires much more reliable numerical values of molecular reaction rates than are presently available. Objective -obtain understanding of kinetic mechanisms and measure accurate values of reaction rate constants for pyrolysis and oxidation of hydrocarbon constituents of present and alternative fuels. How work contributes -the results of these experiments are directly useful to design engineers in jet combustion and plume technology and also to scientists working on the elusive problems of combustion dynamics.

High-temperature homogeneous gas-phase reaction kinetics of hydrocarbon fuel constituents are being studied in flow reactors. The extensive concentration and temperature data obtained as functions of reaction time are used to obtain the correct kinetic mechanisms and global rates and rate constants. Sepctroscopic capability is being added to obtain rate constants of reaction steps involving free radicals. The molecules being studied are carbon monoxide, alkanes from one to six carbon atoms, and selected aromatics representative of possible future jet fuels.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0025, DEVELOPMENT OF LUBRICANT CONCEPTS FOR ADVANCED ENGINES

A.J. DORAZIO, U.S. Navy, Air Propulsion Test Center, *Trenton, New Jersey* 08641 (DN596810)

To provide direction to the engine designer regarding feasible lubricants and lubrication systems.

Obtain and periodically review the Navy's priorities regarding propulsion system concepts which may require advances in lubrication technology for development, maintainability or reliability purposes. Based on these priorities and the relative need for desirability of particular lubrication concepts, conduct studies designed to assess the complexity, feasibility, economy and risk involved in the development of various fluids and systems.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Material Command

3.0026, MEASUREMENT OF FATIGUE DAMAGE WITH DIFFERENTIAL SCANNING CALORIMETRY

P.N. ADLER, Grumman Corporation, *Bethpage, New York* 11714 (DN590205; N00019-76-C-0651)

To establish the applicability of the differential scanning calorimetric (DSC) technique of thermal analysis to monitor the structural reliability of aircraft during service.

DSC measurements are correlated with microstructural changes after varying degrees of fatigue exposure in two tempers of high-strength aluminum alloy 7050.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0027, FATIGUE CRACK NUCLEATION AND PROPAGATION IN ALPHA-BETA TITANIUM ALLOYS

H. MARGOLIN, Polytechnic Inst. of New York, School of Science & Engin., *Brooklyn, New York* 11201 (DF040010; AF-AFOSR-2774-75)

AF function - the longevity, reliability and safety of aerospace structures are related to the fatigue properties of the structural materials used. In fact, the fatigue properties of structural materials often limit their application. Opportunity - thus, it is important to understand the mechanisms of fatigue and especially the metallurgical means by which fatigue resistance may be improved. Systematic studies of fatigue crack initiation and propagation in alpha-beta titanium alloys are of great interest to the Air Force and would make a useful contribution to future development of engineering alloys. Objective -this research will determine the relationship between fatigue properties and microstructure of two-phase (alpha-beta) titanium alloys. Specifically, the Ti-Mn system will be used as a model system for alloys consisting of two ductile phases. How work contributes - alloy composition and heat treatment can be used to vary the volume fraction and morphology of the phases present, and thus, by this study, the most desired microstructures for fatigue resistance can be determined.

Fatigue crack initiation and propagation characteristics will be related to microstructural features such as phases present, particle size and distribution, and dislocation densities. Monotonic and cyclic stress-strain curves will be determined for each alloy composition to aid in interpretation of fatigue data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0028, ULTRASONIC NONDESTRUCTIVE TESTING OF COMPOSITE MATERIALS

W.H. SACHSE, Cornell University, School of Engineering, *Ithaca, New York* 14850 (DF043470; AF-AFOSR-2992-76)

AF function - advanced aerospace vehicles will initiate the use of advanced composites in primary structure in the foreseeable future. New nondestructive techniques will be necessary to insure the structural reliability of this material. Deficiency - no technique has yet been developed to accurately and reliably inspect damage or anomalies in advanced composites. Objective - the objective of this research is to establish the capability of ultrasonics to characterize and quantitatively inspect flaws in advanced composites. In addition, enhancements in using ultrasonics will be investigated. How work contributes - results of this research will contribute to reducing technology uncertainties in the application and maintainability of composite structures.

Both experimental and theoretical research activities will be undertaken in examining the use of ultrasonics in the NDE of composites. Flawed and unflawed specimens will be examined. Attenuation and propagational characteristics will be studied as well as anisotropic factors which can affect the ultrasonic response. Broadband ultrasonic pulses will be used initially in investigating the scattering characteristics of composites and for correlation with theory.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0029, STRUCTURE, PROPERTIES, DEPOSITION CONDITIONS, AND RESIDUAL STRESS IN CVD SILICON CARBIDE AND NITRIDE 14380-MS

R.J. DIEFENDORF, Rensselaer Polytechnic Inst., School of Engineering, *Troy, New York* 12181 (DA0F9037; DAAG29 77 G0167)

To determine the origin and causes of residual stress in chemically vapor deposited materials and to establish a model which predicts these stresses. Relevance - the research is directly relevant to the Army's programs dealing with engines which contain ceramic components. These engines (gas turbines and adiabatic diesels) are being developed for possible use in trucks, aircraft, tanks, and power generation equipment.

Study chemical thermodynamics of the equilibrium concentrations of gases, and determination of the kinetic rate constants for the deposition species for the deposition process. Characterize the microstructure of specimens deposited at various combinations of temperature, pressure, and flow rate. Measure residual stress in the specimens and formulate a model to describe the interrelations between deposition, microstructure, and residual stress.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Box 12211, Research Triangle Park NC 27709

SUPPORTED BY U.S. Dept. of Defense, Army

3.0030, EFFECTS OF OXYGEN AND WATER VAPOR ON THE COMPRESSIVE STRENGTH OF BOUNDARY FILMS ON IRON CRYSTALS

D. SNEDIKER, Battelle Memorial Institute, *Columbus, Ohio* 43201 (DF044220; AF-AFOSR-3051-76)

AF function - propulsion systems for advanced aerospace vehicles require improved lubricants which will withstand a wider range of temperature conditions, greater contact loads and higher shear rates. Deficiency - available lubricants continue to fail due to the detrimental effects of water vapor and oxidation. Objective -investigate the effects of atmospheric oxygen and water on boundary film formation. How work contributes - the information gained from this research will be used to formulate improved lubricants for critical AF applications.

Chemical kinetic methodology will be applied to the study of the film-forming process and the behavior of the films will be determined, as manifested by the compressive strengths, with respect to time, temperature, oxygen and water vapor. It is proposed to (1) study rupture strength in controlled atmospheres as a function of relative humidity and O2 concentration, (2) determine the adsorption isotherms of TcP from E-105 solution, (3) measure friction and damping behavior of E-105 films, and (4) study chemical binding between film and substrate by means of reflection-adsorption spectroscopy.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0031, INTERNAL STRUCTURE AND PHYSICAL PROPERTIES OF CERAMICS, METALS, AND ALLOYS AT HIGH TEMPERATURES

W. TRIPP, Systems Research Labs. Inc., *Dayton, Ohio* 45432 (DF680990; F33615-75-C-1005)

AF function - high-temperature propulsion materials. Thermal protective materials and power generator materials. Deficiency - failure of materials to perform at high temperatures due to oxidation, loss of strength or lack of requisite physical, chemical or mechanical properties. Research - studies of the kinetics of the degradation of metals and ceramics exposed to reactive environment will be combined with microstructural and compositional studies of the matrix and reaction products to determine the degradation mechanism and to suggest potential material improvements. The relationship of composition, defect structure, and microstructure of selected new ceramic materials to their mechanical and physical properties over a wide range of temperatures will be determined to improve their potential for structural, propulsion, and energy conversion applications. How research contributes - an understanding of the fundamental mechanisms responsible for the mechanical, physical, and chemical properties of materials under extreme conditions of applied stress and temperature is essential if significant long-range improvements in these materials are to be made. Once the mechanisms are known, modifications in material composition, microstructure, and surface condition can be undertaken in a more scientific manner to improve material behavior, and new development efforts.

The structure/property studies will require detailed investigation of the raw material and processing factors that influence microstructural development of metals and ceramics, the role of thermodynamic variables in fixing the defect structure and transport properties of these materials, and the role these factors play in determining the mechanisms underlying physical and mechanical properties of technological importance, such as electrical conductivity, high-temperature corrosion, diffusion, sintering creep, strength, deformation and fracture.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Materials Lab.

3.0032, TIME-DEPENDENT RESPONSE OF UNDIRECTIONAL AND LAMINATE COMPOSITES UNDER STATIC AND IMPACT LOADING

G.C. SIH, Lehigh University, School of Engin. & Phys. Sci., *Bethlehem, Pennsylvania* 18015 (NSG 3179)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0033, ENVIRONMENTAL EFFECTS, DAMPING AND COUPLING PROPERTIES OF COMPOSITE LAMINATES

S. KULKARNI, Material Sciences Corporation, *Blue Bell, Pennsylvania* 19422 (DF043310; F44620-76-C-0080)

AF function - Air Force advanced aerospace vehicles continue to require lower-cost structures of enhanced performance and durability. Advance composites as a structural material are a prime candidate to satisfy this requirement. Deficiency - inadequate understanding of dynamic response and environmental effects related to advanced composites is an inhibitor to the application of composites. Objective -the objective of this research is to develop theoretical models of the dynamic properties and environmental degradation of advanced composites and to apply these models to problems involving panel flutter. How work contributes - this research contributes to 6.2 and ADP programs which are developing the technology necessary to apply advanced composites as primary structures to flight vehicles.

The approach will be to develop and solve the governing differential equations utilizing realistic material response which includes the effects of shear deformation, rotary and coupling inertia, and material damping (dynamic viscoelastic behavior of composite laminates). The important influences of the changes in material response resulting from environmental effects will be in-

corporated into the evaluation. These stiffness and damping changes induced by moisture and temperature effects can be expected to influence the desired laminate configuration for flutter resistance. The linear piston theory will be used to model the aerodynamic effects.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0034, INFRARED SPECTRA OF FLUID FILMS UNDER CONDITIONS OF INCIPIENT BEARING FAILURE
J. LAUER, Suntech Incorporated, *Marcus Hook, Pennsylvania* 19061 (DF045910; F49620-76-C-0042)

AF function - propulsion systems for advanced aerospace vehicles require improved lubricants which will withstand a wider range of temperature conditions, greater contact loads and higher shear rates. Deficiency - synthetic lubricants continue to fail at elevated temperatures due to complex chemical and physical interactions of the bulk lubricant with its environment and with both static and moving metal surfaces. Objective - understand the bulk and boundary layer chemical-physical properties of lubricants to determine causes of bearing failure. How work contributes - information gained from this research will be used to formulate improved lubricants for AF application that can withstand conditions of extremely high temperatures, pressures and shear rates.

Infrared emission spectra will be obtained through a window in an operating sliding bearing lubricated by a number of standard fluids. A variety of realistic operating conditions will be probed. The spectra will be analyzed for chemical and physical changes in the fluids (e.g. decomposition, glass transitions), fluid film and metal surface temperatures, and molecular alignment by polarizations. Condition leading to bearing failure will be probed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0035, HYDROGEN ENTRY AND TRANSPORT MECHANISMS IN STRUCTURAL METALS 14057-MS
R.H. HEIDERSBACH, Univ. of Rhode Island, School of Engineering, *Wakefield, Rhode Island* 02881 (DA0E9200; DAAG29 76 G0311)

To investigate hydrogen transport characteristics of structural metals, with emphasis on high hydrogen flux levels, as occur in hydrogen embrittlement cracking, and to investigate surface-entry mechanisms for hydrogen with and without the presence of molecular species which enhance hydrogen entry. Relevance the research is complementary to a current study on the stress corrosion cracking characteristics of ESR and other high-strength steels. Also, the Army has experienced failures of 7075-T6 aluminum, probably due to stress corrosion cracking. The structural alloys to be investigated are widely used by the army in helicopters, ground mobility equipment, tanks, cannons, armored vehicles, and bridges.

(1) Samples of As-cast and also electroslag-remelted (ESR) steels will be subjected to a selected set of controlled hydrogen fluxes, to examine the effect of remelt practice and subsequent impurity levels and microstructure on hydrogen transport. (2) Samples of 7xxx-series aluminum alloys will be studied as above in (1), to investigate the effect of aging on hydrogen susceptibility. (3) Utilization of infrared and Raman spectroscopy to study intermediate surface reactions which enhance hydrogen entry.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0036, ENVIRONMENTAL EFFECTS ON THE THERMO-MECHANICAL BEHAVIOR OF COMPOSITES
T.S. COOK, Southwest Research Institute, *San Antonio, Texas* 78228 (DF043780; F44620-76-C-0093)

AF function - durability of high-performance flight vehicles is of major concern to the Air Force. While composite materials at present offer significant potential, uncertainties in the technical base exist. Opportunity - research leading to a basic understanding of the role that the environment has on advance composite behavior can have significant impact on the development of composite structures. Objective - the objective of this research is to understand the effects of moisture and temperature on composites. This involves understanding the diffusion process and dependent composite parameters. In addition, these effects become manifest through degradation of the material mechanical properties the understanding of which is also sought. How work contributes - this research contributes to the development of low-cost/high-reliability composite structures.

Joint theoretical and experimental program phases are planned. Theoretical research will model the diffusion process as both a coupled and uncoupled phenomenon for comparison with experiments. Major composite parameter will be considered in order to establish model accuracy through test data correlations. Test programs will consider thermal spike, absorption, desorption, and sequence effects.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0037, EXPERIMENTAL AND ANALYTICAL STUDY OF EROSIVE BURNING OF SOLID PROPELLANTS
M.K. KING, Atlantic Research Corporation, *Alexandria, Virginia* 22314 (DF042250; F44620-76-C-0023)

Technical objective AF function - future rocket weapons systems will employ low port-to-throat area ratio designs and as such will be subject to considerable erosive burning phenomena. Deficiency - rocket designers are currently unable to accurately predict erosive burning rates. Objective - this effort will develop and verify an accurate method of predicting propellant burn rates in erosive environments. How work contributes - burn rates for propellants in erosive environment will be accurately predicted.

The effort is both experimental and analytical in nature. The former portion will consist of burning specially formulated propellant samples in an erosive environment where the cross-flow Mach number exceeds one-half. High-speed photography will be used to study burn rates while appropriate instrumentation is used to monitor the flow conditions. A theoretical model of the erosive burning process with a quantitative description of the combustion gas cross-flow will be developed and programmed. This model will be used on a continuing basis to analyze the experimental results of the study. The contractor will also model aluminum particle combustion including the effects of finite-rate kinetics.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, AEROSERVOELASTICITY
M.A. CUTCHINS, Auburn University, School of Engineering, *Auburn, Alabama* 36830 (DF641530; F08635-77-C-0007)

(1) Air Force function - this work unit is developed to define aircraft and weapons dynamic instabilities. (2) Deficiency or opportunity - prevent aircraft loss. (3) Objective - to establish a capability to evaluate and predict instabilities created from the interaction of the automatic control system with the aeroelastic (e.g. flutter) characteristics of the vehicle. (4) How work contributes - this work will define aeroservoelastic instabilities for USAF aircraft when carrying various store configurations.

The techniques and procedures necessary to perform an aeroservoelastic analysis of a winged vehicle will be explored.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

4.0002, INDUCED CURRENTS AND CHARGES ON FINITE-LENGTH CYLINDERS ABOVE GROUND
T.H. SHUMPERT, Auburn University, School of Engineering, *Auburn, Alabama* 36830 (DF042970; F44620-76-C-0054)

AF function - configurations of thin cylinders have been used to model aircraft for the purpose of calculating electromagnetic pulse (EMP) induced currents and charges on aircraft. The calculated distributions have been assumed to vary in the axial direction only. This approximation has been sufficient for a free flight mode. The assumption of axial variation of current and charge begins to break down as the thin cylinders are brought near a ground plane. The validity of thin wire modes can be enhanced by the use of approximate current and charge distributions on the surface of the cylinders in the circumferential direction. Objective - this work is the study of the feasibility of such approximations for a cylinder near a finitely conducting half-space. Contribution - provide useful approximations so that thin cylinder models can be used for an aircraft near a ground plane.

An appropriate first-order distribution function will be introduced into existing formulations for the induced electric current and charge on electrically thin conducting cylinders. The equations will be solved in free space to compare with other solutions. This formalism will then be used to introduce a near ground plane perfectly conducting and finitely conducting. Higher order approximations will be investigated to determine the optimum approximations to use in terms of complexity and benefit gained.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0003, INFRARED OPTICS ANALYSIS

B. JOHNSON, Dynetics Inc., *Huntsville, Alabama* 35805 (DA0F1342; DAAH03-77-M-1036)

The objective of this task is to perform an analysis needed for the development of technical requirements for EOSS related fixed focus collimating and dynamic virtual imaging infrared lens systems. FY77 -my in-house 0.0, funds contract 7.5K.

Analyze EOSS and infrared optical characteristics of missile systems to be evaluated in the EOSS, and develop basic infrared optical design requirements for fixed focus collimating lens and dynamic lens systems which will permit evaluations of infrared missile systems in the confines of the EOSS chamber.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Aeroballistics Directorate

4.0004, SUBMILLIMETER PROPAGATION

W.L. GAMBLE, U.S. Army, Radar Technology Laboratory, *Huntsville, Alabama* 35809 (DA0F1096)

This investigation will provide a research data base for Army systems requiring all-weather target recognition/discrimination and operating in the submillimeter band. The specific objective is to begin to correlate submillimeter wave propagation with micrometeorological parameters in order to utilize climatological data to predict all weather system behavior under any given scenario.

Existing carbon dioxide pumped FIR lasers, klystrons and existing FIR detectors will be used to measure attenuation, forward scatter, backscatter and beam degradation in clear and inclement weather at approximately 750, 850 and 1300 microns. Simultaneous multi-parameter micrometeorological measurements will be made at a number of stations along the path.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Physical Sciences Directorate

4.0005, CHEMICAL LASERS AND LASER-INDUCED KINETIC PROCESSES

G.C. PIMENTEL, Univ. of California, School of Chemistry, *Berkeley, California* 94720 (DF037250; AF-AFOSR-2616-74)

AF function - reconnaissance, communications, weaponry. Deficiency - more efficient, short-wavelength chemical lasers are required to satisfy certain Air Force mission tasks. Existing lasers do not exist to totally satisfy these requirements. Objective - study chemical reaction systems whose exothermic, kinetic, and spectroscopic properties offer the possibility of developing new lasers of higher efficiency over a broad wavelength spectrum with emphasis on electronic, rotational, and polyatomic vibrational lasers. Investigate chemical reactivity in cryogenic reactions. How work contributes - provides detailed understanding of state-to-state reaction dynamics and chemical pumping mechanisms which can lead to development of IR and visible chemical lasers.

Exoergic chemical reactions which produce excitation in rovibrational modes and in electronic states will be examined. Included are reactions to produce high rotational levels in HF and HCl and metal-atom plus oxidizer reactions. Two types of studies of the energetics of cryogenic reactions are contemplated, the stimulation of reactivity through vibrational excitation at low temperatures, and thermoluminescence in cryogenic samples. Multiphoton excitation (5 to 20 quanta per molecule) will be used to initiate unimolecular and bimolecular processes that retain isotopic selectivity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0006, COMMUNICATIONS - IONOSPHERIC TURBULENCE AND MAGNETOSPHERIC-IONOSPHERIC COUPLING FOR EVALUATION OF RADIO COMMUNICATIONS

C.F. KENNEL, Univ. of California, Inst. of Geophys. & Pla. Phys., *Los Angeles, California* 90024 (DN323099; N00014-76-C-0307)

The objective is to evaluate the effect of the ionosphere on radio communication systems used in Navy operations and to help in the design and operation of such systems. The propagation and attenuation of high-frequency, very low-frequency, and very high-frequency radio signals by the ionosphere, by both ground-based and satellite transmitters, are governed by the electron and ion densities in the ionosphere. The present work develops a model to estimate these electron and ion densities as a function of latitude, longitude, altitude, season, time and solar activity. The work also has applications to the estimation of the effects on ionosphere communications due to high-altitude nuclear explosions used, for example, in ballistic missile defense.

Work consists of investigations of ionospheric plasma turbulence, magnetosphere-ionosphere interactions, and magnetospheric substorms. Specifically, this includes the interaction of the auroral electron beam with the earth's ionosphere, plasma instabilities and irregularities in the ionosphere, the viscous coupling of solar wind momentum to the magnetosphere and the associated ionospheric convection electric field and neutral wind pattern, and the saturation of the auroral electrojet instability.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0007, FIBER OPTIC COUPLERS

M.K. BARNOSKI, Hughes Aircraft Company, *Malibu, California* 90265 (DF902560; F19628-77-C-0103)

AF function - airborne and ground communications. Deficiency/opportunity - existing wire systems deficient in terms of bandwidth, security, susceptibility to electrical interference, cost, etc. Objective - development of multiple-access fiber optic links. How research contributes - establishes design and performance parameters for optical fibers and couplers.

Input-output couplers for full duplex operation of a single-strand multimode fiber optic link will be designed and built using tapered fiber sections. Problems to be addressed include fabrication techniques, coupling efficiency and mode-mixing. Properties of the fiber. Access T couplers will be fabricated by controlled fusing together of two fibers using a laser beam. Technical problems are primarily control of the process to produce required characteristics. Fiber attenuation measurements will be refined using the tapered coupler.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0008, UNSTRUCTURED CONTROL AND COMMUNICATION PROCESSES IN REAL WORLD SCENE ANALYSIS

B.L. BULLOCK, Hughes Aircraft Company, *Malibu, California* 90265 (DF038740; F44620-74-C-0054)

Air Force function - command, control, and communications, and intelligence. Deficiency - increasing automation of Air Force functions requires increased capability to manipulate and reduce large amounts of data, particularly images. Objective - provide near real time analysis of imaging systems. How work contributes - scene analysis techniques can be developed to provide assistance in automated analysis of images.

The research will analyze low-level operators to specify their performance. It will then systematically apply these operators to several relevant problems and identify universal scene analysis processes. These formalisms will then be constructed into a generalized system to evaluate its effectiveness over a class of scene analysis problems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0009, COMMUNICATIONS - VLF MAGNETOSPHERIC DUCT PROPAGATION AND WAVE INDUCED PRECIPITATION

R.A. HELLIWELL, Stanford University, Stanford Electronics Labs., *Palo Alto*, *California* 94305 (DN623870; N00014-76-C-0689)

Particle precipitation disruption of naval communication, navigation, and radar systems includes sudden phase anomalies and absorption of ELF and VLF signals, fading of HF signals, and scintillation of satellite signals. Research is performed on the interaction between VLF waves and magnetospheric particles which causes the precipitation, and on the effects on the ionosphere, and on vlf signals propagating in the earth ionosphere waveguide.

Theoretical analyses of VLF coupling into and out of magnetospheric ducts, propagation in the ducts, wave particle interactions, particle precipitation, excess ionospheric plasma generated by the precipitation, and the effects on earth-ionosphere ducted VLF signals are compared with experimental measurements of VLF signals from Navy transmitters, of natural VLF whistlers, signals from the Siple transmitter, and signals generated by power line harmonics.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0010, TWO-DIMENSIONAL UNSTEADY FLOWS AT TRANSONIC SPEED

R. MAGNUS, General Dynamics Corporation, *San Diego*, *California* 92138 (DN223816; N00014-77-C-0051)

The prediction of aircraft performance during rapid maneuvering, while encountering gusty environments, or to avoid flutter requires a knowledge of unsteady aerodynamic forces. The purpose of this task is to develop a methodology for predicting unsteady flow fields about airfoils at transonic speeds and to apply this methodology to assess more approximate analytical approaches for such calculations.

Though rapid advances have been made in the numerical solution of complex flow problems, the calculation of unsteady aerodynamic flows about three-dimensional configurations by 'exact' finite-difference techniques remains a distant goal for most purposes because of the computing time required. Approximate techniques, analytical or numerical, invariably introduce assumptions which can seriously limit the range of applicability of the analyses. The effects of the different approximations can be assessed for two-dimensional flows by more exact finite-difference procedures, much like a numerical wind tunnel, so that three-dimensional analytical theories can be developed on a firmer foundation. This research will develop finite-difference equations for inviscid flow to handle truly unsteady transonic flows. Initially, pure sinusoidal pitching oscillations of airfoils will be studied.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0011, DEVELOPMENT OF LABORATORY VERSION OF ADVANCED GCA CONTROLLER TRAINING SYSTEMS

L. EGAN, Logicon Incorporated, *San Diego*, *California* 92110 (DN494015; N61339-74-C-0048)

To develop techniques for improving quality control while reducing costs in the training of personnel to perform a class of control activity such as ground control approach, ground-controlled intercept and certain functions of the radar intercept officer. These jobs have in common the need to use restricted, stylized speech to guide a recipient man-machine system to a well-defined goal. This task will examine the potential for more effectively meeting controller training requirements of combining advanced technologies including, but not limited to, the following: (a) machine understanding of spoken commands, (b) automated adaptive training, (c) advanced corputer programming, (d) advanced training requirements analysis.

Develop enough of a system to demonstrate the feasibility of the concept in the case of a single GCA controller guiding a single aircraft. An earlier study produced an analysis of requirements and a functional design for a training system directed to the par phase of the GCA. The current effort is to implement and debug the design to provide a laboratory version of the training system.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Training Equipment Center

4.0012, 7.9GHZ-8.4GHZ AMPLIFIER FOR TDMA SATCOM

M.V. KREISMANIS, Hughes Aircraft Company, *Torrance*, *California* 90509 (DF742360; F30602-76-C-0105)

The object of this effort is to develop a 20 kw peak power traveling wave tube with an instantaneous bandwidth from 7.9 gHz to 8.4 gHz. This tube is required by DC for use in the transmitter chain of their time division multiple access (TDMA) SATCOM system test bed. This program will be a 9-month effort to properly interface with the time line of the TDMA SATCOM system test bed. Additional specifications as required by the system are as follows: gain - 53 db, duty - 5 percent, pulse length - 200 microseconds, modulation - shadow grid (less than 700 nanosecond rise and fall times), focusing - ppm, cooling - dielectric oil, efficiency - 25 per cent minimum and phase linearity plus or minus 10 degrees, and phase pushing - (cathode) .16 degree/volt, (grid) 2.5 degree/volt, (RF drive) 6 degrees/db.

This effort will consist primarily of a frequency and power scaling from present traveling wave tube designs. The slow wave structure will probably require the most development because it must be tailored to give the required frequency band and gain. It is hoped that gun and collector designs can be taken almost directly from existing tube designs to keep costs to an absolute minimum.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0013, NUMERICAL CALCULATION OF FLOW IN A CASCADE WITH SPLITTER VANES

L. WALLIT, Numerical Continuum Mech. Inc., *Woodland Hills*, *California* 91364 (DF459160; F33615-76-C-2011)

There are three technical objectives: (1) to test the accuracy of the contractor's three-dimensional transonic, viscous numerical flow model against appropriate experimental data, (2) to obtain a description of the three-dimensional flow in a specific axial compressor blade row containing splitter vanes, and (3) to assist in establishing the validity of a cascade test incorporating converged side walls. The application of the results is in improved accuracy of compressor blade-row designs resulting in higher efficiency and reduced development costs for aircraft turbine engines.

The contractor has developed a computer code for three-dimensional transonic, viscous flow calculations under company and NASA support. Its accuracy has not yet been verified by comparison with adequate experimental data. Under this contract, the contractor will evaluate his numerical model by using it to calculate the three-dimensional flow field for a specific blade row geometry for which the Air Force has extensive experimental data and for which it is desired to learn more about three-dimensional characteristics of the configuration which were not possible to measure. The greatest problem area associated with three-dimensional, transonic, viscous flow calculations is the turbulence model used. This effort will also explore an improved turbulence model.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

4.0014, ATMOSPHERIC FLIGHT AERODYNAMICS AND ENVIRONMENT
J.H. DELEEUW, Univ. of Toronto, *Toronto, Ontario, Canada* (DF044390; AF-AFOSR-3028-76)

AF function - aerospace vehicles. Deficiency/opportunity - aeronautics depends intimately on as complete as possible knowledge of the atmosphere and its influence on flight. Of the many important aspects of this problem, one is the disturbance to flight caused by the complex low-level flow patterns generated by buildings, terrain features, or vegetation near aircraft landing areas. Another aspect of importance to satellite and missile operations concerns the density, composition, and thermodynamic condition of the upper atmosphere. Objective - to predict aircraft deviations from desired flight profiles at the end of a landing approach through the turbulence of the earth's boundary layer and through the disturbances of various locales, also to continue measuring the upper atmospheric parameters, density, translational and rotational temperature, and concentration of oxygen molecules and atoms, nitrogen molecules and atoms, and nitric oxide. How work contributes - the landing approach work coordinates the practical aspects of landing aircraft of various types with the fluid mechanical research and measurement necessary to predict accurately whether a given set of conditions can lead to a satisfactory landing, as well as what possible countermeasures are necessary in order to land despite unfavorable conditions. The work on upper atmospheric measurement is advancing the art of making such measurements per se and at the same time collecting useful data on the environment in which satellites and missiles must operate as must also the relevant detection and identification methods.

Laser Doppler measurements of locale-related turbulence and measurements made in a controlled-turbulence wind tunnel will be used in conjunction with known aerodynamic and control system characteristics of selected aircraft to predict, by means of a computer, the flight profiles to be expected. These will be compared with actual flight records available from Canadian commercial and military sources. The electron beam fluorescence probe and the aerodynamic spectrometer will be again included as part of the payload of a black Brant high-altitude sonde.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0015, PRODUCTIVE APPLICATIONS OF AEROELASTICITY
S.M. BATILL, U.S. Air Force, Aeronautics Department, *Colorado Springs, Colorado* 80840 (DF282150)

AF function - technology base. Deficiency - requirements for the most efficient use of energy resources have established a need for research directed toward more efficient means of flight. Objective - a study will be made of low-speed airfoils to determine how applications of aeroelasticity such as time-varying camber, thickness, and twist could increase the efficiency of flight. How research contributes - will result in feasible methods of improving endurance, range, fuel economy, etc., through aeroelasticity.

After a thorough literature survey, a numerical study will be performed with emphasis placed on the development of a method for enforcing the flow boundary conditions on thick, nonsteady airfoil sections undergoing cyclic or quasi-cyclic motion. Computer graphics techniques will be used. The objective is to determine optimum aerodynamic cycles for different mission requirements. Long-range plans call for subsonic wind-tunnel tests to verify those concepts which appear most feasible as a result of the numerical study.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Frank J. Seiler Research Lab.

4.0016, AERODYNAMIC WINDOW PERFORMANCE AND OPTICAL QUALITY
R.N. GUILE, United Technologies Corp., *Hartford, Connecticut* 06108 (DF036140; F44620-73-C-0031)

AF function - weaponry. Deficiency - aerodynamic windows for airborne gas lasers show high sensitivity of window gas leakage rates to pressure adjustments for varying flight altitudes. Better understanding and control of the window and wall boundary layers could make possible design and operation techniques to control the leakage rates to within acceptable limits. Objective - to measure the characteristics of the endwall boundary layers in a model aerodynamic window and to discover the role these boundary layers play in the observed aerodynamic window leakage, also, to investigate means of controlling the end wall boundary layers in order to reduce the leakage flow to satisfactory levels. How work contributes - aerowindow requirements include leakage rates between an acceptable minimum and maximum, correct pressures at inner and outer boundaries to match the cavity and atmospheric pressure, and low phase distortion of the laser beam. Control of the endwall boundary layers may be the only way to achieve the first of these requirements, since the other two requirements use up all the other adjustable parameters of the window operation.

An existing aerowindow model will be connected to a simulated laser cavity and to a wind tunnel air supply. The end wall boundary layer will be probed for pitot and static pressure distribution, and leakage rates into the cavity will be measured. Flow visualization methods will also be used. Possible methods of altering leakage rates will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0017, STRUCTURAL OPTIMIZATION OF HEAT-STIFFENED PANELS OF COMPOSITE MATERIALS SUBJECTED TO THERMAL AND IN-PLANE MECHANICAL LOADS
J.R. VINSON, Univ. of Delaware, School of Engineering, *Newark, Delaware* 19711 (NSG 1488)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0018, OPTICAL MICROCIRCUITRY
T.G. GIALLORENZI, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN120207)

(a) To investigate both theoretically and experimentally acousto-optic and electrooptic processes in optical waveguides; (b) to utilize these effects to fabricate optical circuits for use as terminals; (c) to develop signal processors using integrated optical technology; (d) to investigate possible thin film-optical fiber couplers. The Navy has a continuing need for optical devices and systems with emphasis on efficiency, size, weight and versatility. These characteristics are features of microoptics.

(a) Using sputtering and indiffusion techniques, construct waveguide structures such as channel waveguide couplers, overlay interconnects and modal lift-off stuctures. (b) Demonstrate active waveguide devices in indiffused ferroelectrics and on silicon substrates. (c) With surface acoustic waves study acousto-optic interactions spectrum analysis and fabricate optical methods of tapping acoustic signal processors. (d) Study polarization characteristics of light transmitted in fibers and integrated optical device performance when two polarizations are present.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0019, SEVEN-OHM BEAM-PLASMA EXPERIMENT
A.E. ROBSON, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN480011)

The primary technical objective of the seven-ohm beam plasma interaction experiment is to assess the usefulness of high current electron and ion beams for heating and preheating of plasmas which are to be used in radiation simulators. A secondary objective is to understand the interaction of high current electron and ion beams in complex magnetic configurations with and without plasmas for conversion of beam kinetic energy to plasma thermal energy or radiation. An understanding of these interactions will provide the basis for further advances in the field of electron and ion beam weapons.

A beam of electrons (40 ka, 500 kev) or ions (3ka, 400 kev) is injected into a gas or a preionized plasma and the interaction of the beam with the plasma is studied under a wide range of conditions. By reversing the polarity of the generator and modifying the diode, ion beams of several ka are produced.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0020, CATHODE RESEARCH
R. THOMAS, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN320136)

The objective is to design and develop new cathodes for microwave tubes by using principles established from basic surface physics studies and state-of-the-art cathodes and related surfaces.

Surface analysis techniques, such as scanning low-energy electron probe (SLEEP), Auger spectroscopy, low-energy electron diffraction (LEED), and reflection (LEER), quadrupole mass spectroscopy therminie emersion microscope (THEM), and scanning electron microscopy (SEM), in addition to thermionic emission and life tests will be used to analyze existing cathodes and experimental NRL prototype cathodes as a guide to determine what variations in impregnant materials and techniques, matrix materials and fabrication methods are most effective in producing surfaces with high thermionic emission and minimal evaporation products.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Electronics Systems Command

4.0021, RESEARCH ON CHEMICAL LASERS
W.S. WATT, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN020119)

The Department of Defense has need for high-power lasers that operate with high efficiency. Availability of such lasers has significance for communications and weapons applications. Chemical lasers that require no external excitation and which convert chemical energy into laser power offer the prospect of highly efficient operation. The technical objective is to investigate suitable chemical laser reactions that directly result in excited-state molecules that will lase at useful wavelengths with high potential power output and with high efficiency. Lasers utilizing such chemical reactions would thus become available for defense applications.

Exothermic chemical reactions which occur in static and flowing gas mixtures are being investigated for chemical laser sources. Thermal, photochemical and electric-discharge schemes are used to initiate these reactions. Energy transfer, reaction rates and spectroscopic processes are being studied.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0022, FUEL DUMPING BY USAF A/C
H.J. CLEWELL, U.S. Air Force, Civil & Environ. Eng. Dev. Off, *Panama City, Florida* 32401 (DF407170)

To assess the extent and environmental impact of fuel dumping by USAF aircraft, and to determine optimal procedures for minimizing any negative impact.

Extent of AF fuel dumping will be assessed by establishment of an AF-wide fuel dump reporting system and tabulation of reports. Physical behavior of the dumped fuel will be determined through wind tunnel modeling, computer simulation, and studies of actual dumps.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Civil Engineering Center

4.0023, COMBUSTION DYNAMICS OF EXTERNAL BURNING PHENOMENA
W.C. STRAHLE, Georgia Inst. of Technology, School of Engineering, *Atlanta, Georgia* 30332 (DF040500; AF-AFOSR-2794-75)

AF function - weapon delivery and defense, advanced air-breathing propulsion systems. Deficiency - insufficient fundamental understanding of the basic fluid dynamic and combustion dynamic processes associated with external burning in turbulent reactive flows behind bluff-based bodies. objective - to formulate realistic theories and mathematical representations of the phenomena associated with external burning and to provide the experimental data needed to validate the theories. How work contributes - will provide additional understanding and realistic theories and analytical models describing the external burning phenomena and capable of predicting the effects on base pressure of the many processes occurring, will contribute towards determination of the feasibility of the external burning concept for propulsion, rapid control, etc.

This program encompasses theoretical and experimental studies directed at elucidating the effect of combustion dynamics upon air-breathing propulsion method of external burning. The objective is to determine the effects of several combustion-related processes on base pressure behind axisymmetric bodies at a free stream Mach number of 3.0. Investigated will be: (1) the effect of pressure waves generated by a simulated combustion field external to the near wake upon the base pressure, (2) the effects of cold gas injection, peripheral to the base in discrete probes near the base of the body. In all cases, experimental arrangements will be designed and guided by an analytical model of external burning. The experimental results will be used to modify the theory so that it becomes a useful analytical tool for external burning for air-breathing propulsion.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0024, PROCESSOR ARCHITECTURE SIMULATION
R.T. CHIEN, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (DF097760; F33615-74-C-1112)

To develop the capability to simulate and evaluate different processing systems for use in future aerospace applications. By examining the processor architecture and the software requirements simultaneously, hardware/software trades can be evaluated without extensive hardware development. Hence a wide spectrum of processor systems can be examined with only the most appropriate systems developed for AF applications.

To develop the simulation hardware and software required to support processor system investigations. The processor architecture simulator would then be delivered to AFAL as a tool to allow AF personnel to investigate and evaluate processor system capabilities in response to future aerospace requirements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0025, THE EFFECT OF ATMOSPHERIC PARTICULATE MATTER ON THE PROPAGATION OF A LASER BEAM 14372-GS
P. CHYLEK, Purdue University, Purdue Research Foundation, *Lafayette, Indiana* 47907 (DA0F8903; DAAG29 77 G0049)

To investgate the effects of nonsphericity of aerosols on the propagation of both visible and infrared laser beams through the atmosphere containing dust particles. Relevance - more precise definition of the scattering effects on nonspherical aerosols on laser propagation through the atmosphere will be applicable to the high-energy laser test experiments, the non-line-of-sight optical communications program, investigations of system performance of night vision sensor systems, the design and operation of terminal homing systems, and to laser remote sensing systems.

Calculate light scattered and absorbed by atmospheric dust assuming (1) spherical particles and using MIE theory, and (2) nonspherical particles and using an approximation method based on the assumption that surface waves are present in scattering by spherical particles and absent in scattering by irregular particles.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0026, ANALYTICAL AND EXPERIMENTAL STUDY ON IMPACT DAMAGE OF LAMINATED COMPOSITES
C.T. SUN, Purdue University, School of Engineering, *Lafayette, Indiana* 47907 (NSG 3185)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0027, COMMUNICATIONS - SOLID-STATE ELECTRONIC COMPONENTS AND CONTROL-JSEP
N. BLOEMBERGEN, Harvard University, School of Engineering, *Cambridge, Massachusetts* 02138 (DN624307; N00014-75-C-0648)

To provide the Navy the technological basis for improved solid-state and electromagnetic components and devices for communications, surveillance, navigation and information handling by taking advantage of vast expertise available at institutions of recognized standing such as this one under the Joint Services Electronics Program. The study of fundamental physical and electronic processes and properties leads to advancement in the technology of lasers and optical components, heat-sensitive detectors, accurate navigation schemes, missile and aircraft guidance and control, high-performance microelectronic circuitry having small size and weight and methods for handling efficiently large amounts of data.

The subject emphasis at Harvard is in nonlinear optics, laser light scattering in liquid crystals, laser interaction with superconductors, laser interaction with semiconductors, amorphorous semiconductors, control theory and applications, theory of optimized decision making, system modeling and air traffic control, nonlinear oscillations, and in electromagnetic theory antennas and radiating systems.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0028, TWO-CHANNEL MILLIMETER WAVE PHASE LOCKED RECEIVER
P MAHONEY, Signatron Incorporated, *Lexington, Massachusetts* 02173 (DF901090; F19628-76-C-0060)

AF function - high data rate communications. Deficiency or opportunity - current communication frequency bands heavily allocated -new frequency bands are required for high data rate, highly secure communication channels. Objective - investigate the limitations imposed by the atmosphere on the utilization of millimeter wavelengths for earth to space communications. How research contributes - Bell Telephone Laboratories in cooperation with the Comsat Corp. is placing three millimeter wave beacons operating at 19 gHz and 28 gHz on board three synchronous orbit communication satellites. These beacons will operate continuously for a period of up to seven years and are available for use by anyone with the applicable ground receiving systems. These beacons provide a unique opportunity to obtain needed propagation data specifying the effects of the atmosphere and the weather upon the amplitude, relative phase vs. bandwidth and the polarization of millimeter wave signals traveling an earth-to-space path. The effort covered by this report will supply AFCRL with a two-channel receiver capable of receiving the beacon signals and providing the propagation data necessary to adequately specify the utility of millimeter wave earth-to-space communication.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0029, LASER DIAGNOSTICS OF METALLIC PLASMAS
D.R. BACH, Univ. of Michigan, School of Engineering, *Ann Arbor, Michigan* 48106 (DF039640; AF-AFOSR-2713-74)

AF function - operation of high-altitude vehicles in a post-nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand advanced equipment unavailable to date. Deficiency - present-day information is inadequate to design the aforementioned equipment. Such information may be obtained from experimental and theoretical work in metallic (collisional) plasmas. Objective - this project will investigate experimentally various laser diagnostic methods on high-density metallic plasmas. Both exploding wires and z pinch plasmas will be investigated, specifically aluminum and tungsten wires. Contribution - this work is a part of a comprehensive program on plasma research for the development of an X-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and ion beam), the development of space and ionospheric communications and the development of countermeasures.

This project will use the information obtained from lithium exploded wire plasmas to extend it to higher z wire plasmas of aluminum and tungsten in the investigation of low-energy X-ray emission from the plasma. These X-ray emission measurements will be compared with the calculations of Drs. Ong and Duderstadt (AFOSR grant 76-2904). The explosion wire system will be rebuilt in such a way that the plasma can be heated in the radial direction by using the high-intensity CO2 laser in the axial direction in order to simplify the geometry to perform better comparisons between the calculations and experiments. Attempts will also be made to determine the geometrical shape of the X-ray emitting regions using X-ray pinhole photography.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0030, ANALYSIS AND PREDICTION OF DYNAMIC AIRCRAFT TIRE DATA FROM STATIC MEASUREMENTS
S.K. CLARK, Univ. of Michigan, School of Engineering, *Ann Arbor, Michigan* 48106 (NSG 1494)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0031, A COMPREHENSIVE PROGRAM OF COMPRESSIBLE TURBULENT BOUNDARY LAYER RESEARCH
G.S. SETTLES, Princeton University, Graduate School, *Princeton, New Jersey* 08540 (NSG 2299)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0032, THEORETICAL RESEARCH ON VISCOUS INTERACTIONS
M.H. BLOOM, Polytechnic Inst. of New York, School of Science & Engin., *Brooklyn, New York* 11201 (DF028870; AF-AFOSR-2635-74)

AF function - advanced aerospace vehicles. Deficiency - in order for the Air Force to improve flight vehicles in the future so that their operational capabilities will be superior to those of any potential enemy, new aerodynamic prediction methods are needed. The performance of such vehicles depends on the ability of the engineer to predict the forces, moments, heat transfer rates, etc., acting on the aerodynamic shape of the vehicle. Present prediction methods are only able to solve simplified shapes and deal with ideal gases and assumed models of viscosity, turbulence. Objective - to develop improved analytical tools that can be used to predict the aerodynamic behavior of complex vehicle shapes. How work contributes - this research continues to refine methods for handling three-dimensional flows, viscous-inviscid interactions, cross flow boundary layers and transient behavior of flows. Recent work by Piny has led to new analytic and numerical approaches in three-coordinate flow problems and viscous interactions.

Methods of solution are primarily derived from a combination of improved analysis and numerics. Specific problem areas include low-speed flow in inlets, wing-body interference and free viscous-inviscid pressure interactions on slender aerodynamic configurations and the evaluation of improved numerical procedures using spline interpolation, for the calculation of both laminar and turbulent boundary layer interactions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0033, PROPOSAL TO VERIFY ROCKET EXHAUST PLUME EFFECT SIMULATION TECHNIQUES 13797-E
C.F. REID, Calspan Corporation, *Buffalo, New York* 14221 (DA0F8934; DAAG29 77 C 0008)

To investigate the validity of a cold jet simulation of rocket exhaust plume effects by direct experimental comparison between hot and cold jet base and afterbody pressures and between calculated pressures based on cold jet modeling and measured hot jet pressures. Relevance -the research is directly relevant to the understanding of plume effects on missile aerodynamics which is important because of the possible adverse effects of plumes and because of the potential for improving the accuracy of free rockets. Such technology is one of the principal thrusts of the Aeroballistics Directorate at MICOM.

Base and afterbody pressure measurements and Schlieren photographs of the plume from a solid fuel rocket engine will be made used for comparison with an analytical model based on cold jet simulation of the hot jet and with cold jet experimental measurements of similar quantities.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0034, TRANSITION PROBABILITY AND PRESSURE BROADENING PARAMETERS OF COPPER ATOMIC LINES
W.H. WURSTER, Calspan Corporation, *Buffalo, New York* 14221 (DF133750; F33615-75-C-3082)

Performance of high-speed ballistic missiles has outpaced the capability of ground test facilities to simulate the severe conditions encountered during reentry. A significant technical lag exists in the area of thermal measurement instrumentation. The objective of this effort is to generate fundamental spectroscopic data which is required as input information to thermal measurement techniques presently under development for ground-based test facilities. Successful development of quality ground-based facilities will significantly reduce the amount of free-flight testing required, thus significantly reducing the cost of new reentry technology.

The high temperatures of the gas in the nose tip region of reentry models make a direct physical measurement of the gas temperature extremely difficult. Therefore, a spectroscopic diagnostic technique to measure the nose tip gas temperature is under development. This technique uses the intensity of two spectral lines of a flow contaminant, copper. In order to relate these copper spectral line intensities to the nose tip gas temperature, fundamental spectroscopic atomic data is required (i.e., transition probability and line broadening parameters). It is the function of this contract effort to have these copper atomic properties measured using a test facility whose thermal properties are already known accurately.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0035, LASER INDUCED FORCED MOTION AND STRESS WAVES IN PLATES AND SHELLS
H. REISMANN, State University of New York, School of Engin. & Appl. Sci., *Buffalo, New York* 14214 (DF042530; AF-AFOSR-2943-76)

AF function - laser weapons technology continues to develop and, for this reason, Air Force flight vehicles may some day be required to incorporate design-protective schemes to avoid critical damage caused by laser firings. This research offers a fundamental study of laser-induced effects for induced motion and stress waves in plates and shells. Opportunity - the understanding of structural response to laser beams will provide a basis for the study of survival techniques and design improvement programs. The opportunity for research in this area is now, before threat and system problems exist. Objective - the objective of this research is to develop sound, substantial theories which describe the time-dependent response of metallic structures to pulsed laser radiation. How work contributes - this research is part of the AFOSR mission to provide a basic understanding of, and approaches to, structural behavior under exposure to those environments of concern to the USAF.

Experimentally this program proposes to execute a series of laser irradiations to test the response of restricted plates as targets. Theoretically, this program will attempt to resolve the axisymmetric problem of a clamped, circular plate using eigen functions. Hankel transforms will be used to obtain a solution for an infinite plate condition.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0036, 2.8 MICROMETER INFRARED HETERODYNE RADIOMETER
F. PACE, Cutler Hammer Incorporated, *Huntington, New York* 11746 (DF186970; F29601-76-C-0045)

Information on high-altitude long-path atmospheric absorption of laser radiation is a vital requirement for the Air Force high-energy laser program. Even trace amounts of some atmospheric constitutents can significantly absorb laser radiation over long propagation paths. The objective of this effort is to develop a technique for measuring long-path absorption at high altitudes and to design and build a device for that purpose.

The approach to be taken is to use infrared heterodyne radiometry. The concept is to optically mix laser radiation with solar radiation giving a measurement of the solar radiation intensity at that laser frequency. As the atmosheric path length changes during the day, the measured change in solar intensity gives the atmospheric absorption at that laser frequency.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons Lab.

4.0037, ELECTRIC CURRENT CONTROLLED LIQUID-PHASE EPITAXY OF COMPOUND SEMICONDUCTORS
L.F. EASTMAN, Cornell University, School of Engineering, *Ithaca, New York* 14850 (DF042110; AF-AFOSR-2929-76)

AF function - microwave solid-state electronic devices are essential components of Air Force surveillance, electronic countermeasures, and communications systems. Opportunity - devices made from gallium arsenide and indium phosphide show great promise for improved performance and reliability in the microwave region. In order to take full advantage of the capabilities of these compound materials, it is necessary to obtain improved control over the epitaxial growth process of these semiconductors. The present method of liquid-phase epitaxy has been reasonably successful, but this method does not allow for a fast enough response time for controlling epi-growth rates or for an independent control of doping density in the epitaxial layer. Objective - the objective of this research is to obtain control over epitaxial growth rate and doping density by means of the electric current induced Peltier cooling effect. How work contributes - if successful, this work will demonstrate the effectiveness and usefulness of the LPE technique for the growth of compound semiconductor device structures.

The main task of the research for this renewal period will be the current controlled growth of InP. A combined spectrasil and graphite boat has already been constructed and tested under conventional growth conditions. The indium to be used for epitaxial growth will be subjected to an extensive pre-bake cycle involving a flowing hydrogen and dilute water vapor atmosphere in order to remove silicon which is the main impurity in the indium. Both n-type (tin doping) and semi-insulating (iron doping) substrates will be used for the epitaxial growth at current densities ranging from 0-30 amps-per-square-centimeter. The Van der Pauw technique will be used to obtain data on the mobility and net electron concentration of the epitaxial layers. Schottky barrier diodes will be used in order to obtain a depth profile of the doping concentration. Finally, InP Gunn diodes will be fabricated from the material grown by current control techniques. The devices will be tested in the 5-10 gHz range and are expected to exhibit improved performance over InP devices grown by conventional liquid-phase epitaxial techniques. If time permits, work will proceed to the initial phases of current controlled growth of a ternary compound such as AlGaAs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0038, ASYMMETRIC BOUNDARY LAYER TRANSITION ON BALLISTIC REENTRY VEHICLES
R. VAGLIOLAURIN, New York University, School of Science & Engin., *New York, New York* 10003 (DF048560; AF-AFOSR-3359-77)

AF function - aerospace vehicles. Opportunity - to develop a deeper understanding of the mechanisms controlling hypersonic boundary layer transition over slender reentry vehicles. Objective - to ultimately evolve a rational, efficient, and reliable hypersonic boundary layer transition prediction/design methodology. How work contributes - this study will identify the effects of environmental and material characteristics on the hypersonic boundary layer transition process over pointed and/or slightly blunted slender cones such as are employed in advanced reentry vehicles.

A theoretical investigation using forced response-stability modeling of the boundary layer transition process will be made with specific emphasis given to such influences as environmental perturbations, angle of attack and material interactions. Validation of the analyses will be made against laboratory and/or free-flight data wherever possible.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0039, ELECTROOPTICAL MODELLING ANALYSIS
B. BENDOW, U.S. Air Force, Rome Air Development Ctr., *Rome, New York* 13440 (DF902730)

AF function - command, control and communications. Deficiency -high acquisition and O&M costs of c cubed systems. Objective - develop underlying device technology for future c cubed systems. How research contributes - this effort is directed toward the realization of new signal processing devices, device technologies and techniques with the goal of substantially improving the availability, reliability and performance of future c cubed systems. Specific efforts will be directed towards increasing single component functional capability, evaluation of the underlying device mechanisms which limit device algorithms for c cubed signal processing requirements.

Charge transfer devices (CTDs, CCDs, DIDs) can be implemented with a wide range of differing functional capabilities that promise to revolutionize future c cubed system architecture. Full development of these devices will result in systems with expanded capability, lower component count and substantially lower life cycle costs. Research efforts will address improvement of CTDs through evaluation of the physical mechanisms which limit performance and the development of new device processing techniques and designs with goals of increasing operational dynamic range, reduction of dark current and noise limitations, and extending frequency response. In addition new device algorithms will be evaluated from the viewpoint of developing more efficient signal processing components.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0040, SPECTROSCOPIC STUDIES OF THE ELECTRONIC STRUCTURE OF SEMICONDUCTOR INTERFACES
D.E. EASTMAN, Internat. Bus. Machines Corp., *Yorktown Heights, New York* 10598 (DF042670; F44620-76-C-0041)

AF function - modern aerospace electronic systems for command, control and communications, and for surveillance and reconnaissance depend heavily upon solid-state electronic and optical devices. Opportunity - future improvement in performance of these devices requires a thorough understanding of the electronic structure and excitation processes in selected solids. Objective - the objective of this research is to provide knowledge of the electronic structure, electronic transitions and interactions, and optical properties at semiconductor interfaces that are vital to microwave device operations. How work contributes - this work will provide knowledge and understanding of interface states that will permit the development of more reliable and efficient microwave devices for the above system.

The electronic structure and properties of semiconductor interfaces, including metal-semiconductor Schottky barriers, of III-V semiconductors, selected group IV, and ternary III-V alloy semiconductors will be studied by a variety of techniques including photoelectric yield and photoelectric spectroscopy using synchrotron radiation, and electron energy-loss spectroscopy, Auger electron spectroscopy and low-energy electron diffraction.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0041, SOLAR CELL DESIGN STUDY
M.F. LAMORTE, Res. Triangle Institute, *Durham, North Carolina* 27709 (DF105650; F33615-76-C-1283)

An advanced design of solar cells is necessary to support the power requirements of the Air Force space program in the 1980s. The objective of this contract is to determine which of the various III-V materials would be the best candidate to develop for the next generation of solar cells. The study will also address the question of which structures should be developed and will predict the maximum efficiency that could be expected from various materials and structures.

The approach to be followed is to look at each of the III-V ternary systems that cover the wavelengths associated with solar radiation. The inherent advantages and expected problems of each of these systems will be delineated. If a system looks promising then all the structures that could be used with that system will be delineated and evaluated. The last portion of the effort is to make recommendations as to the best material and structure to evaluate.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0042, HYBRID PACKAGING OF INTEGRATED CIRCUITS
H. KAST, General Electric Company, *Cincinnati, Ohio* 45215 (DF457320; F33615-74-C-2070)

Develop improved hybrid electronic microcircuit modules for hard-mounting on, and control ultimately of, gas turbine engines. The modules are to be packaged in such a way that common mechanical failures of electrical components are obviated.

This is a 30-month program in which the seven tasks will be performed-- Task 1. Selection of control module, 2. Design and fabrication, 3. Procurement of IC chips, 4. Complete hybrid assembly, 5. Bench testing, 6. Engine testing, and 7. Preparation of a final technical report.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

4.0043, PULSED SUPERCONDUCTING SHAPING CIRCUIT
O.K. MAWARDI, Case Western Reserve Univ., School of Engineering, *Cleveland, Ohio* 44106 (DF041680; AF-AFOSR-2886-76)

AF function - the Air Force has a requirement to develop lightweight, high-power energy storage systems for a variety of applications in aircraft and space vehicles. Deficiency - present capacitive energy storage techniques do not permit the storage of large amounts of energy (greater than 10 megajoules) economically or at high energy density. Objective - the objective of this proposal is to develop a fast, repetitive pulse inductive energy storage system based upon superconducting technology. To store energy inductively simply means to store it in magnetic field. The limitations on this kind of storage are the strength of materials. The conductors carrying high current experience a repulsive force which can distort the conductors. This limitation allows energy storage at hundreds of times that available from conventional capacitive storage (energy storage in electric fields) techniques, where the limitation is dielectric breakdown strength. Contribution - this research will contribute to the development of large energy storage systems and to systems with high energy densities.

The three elements of the inductive energy storage system are an opening switch, a storage inductor, and a charging system. Superconducting technology is important to the development of both the switch and the storage inductor because superconductivity offers higher magnetic field strengths and therefore higher energy density, rapid switching capability, and low resistive losses. Mawardi's design for an inductive storage system is the inductive analogue of the Marx generator. The basic concept makes use of a number of inductors that are energized in series and discharged in parallel, multiplying the charging current by the number of inductors. Flux pumps using a matrix of superconducting wires are used to charge the inductors. This phase of the program emphasizes the output circuit for the inductive storage. These systems are normally current generators rather than volt-

age generators. To supply high output voltages to low impedance loads, Mawardi has developed a voltage multiplying transmission line circuit which he calls a pushnet. In this program they will design and construct a superconducting pushnet, test its performance in terms of pulse length, shape, and voltage multiplication, and continue the theoretical development to determine dependence of pulse length on various parameters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0044, ANALYSIS OF AIRBORNE ANTENNA PATTERNS
W.D. BURNSIDE, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (NSG 1498)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0045, DIFFUSION SYSTEMS HAVING HIGH PRESSURE RECOVERY FOR RADIAL SUPERSONIC FLOWS
J.D. LEE, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (DF042820; AF-AFOSR-2956-76)

AF function - advanced laser technology. Opportunity - improvement in our knowledge of radial outflow diffusers. Objective - gas lasers normally operate with the cavity pressure below that of the local atmosphere to which the flow is to be discharged and high pressure recovery of the flow and/or pumping devices are required. These must be efficient and compact. The objective is to gain a basic understanding of the flow field in a short, multichannel diffuser with mixing from local multiple ejectors. The program will contribute to the design and operation of more efficient, compact diffusers and ejectors. How work contributes - this program will provide data usable in the design of diffusers for chemical lasers.

Coplanar and cylindrical multi-channel supersonic nozzle arrays will be used to supply simulated laser cavities, both cold and heated, which will be processed through diffuser systems with and without local ejector nozzles. The latter will be used both for boost-pumping and for local boundary layer control.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0046, SYSTEM RELIABILITY/MAINTAINABILITY
T. JAMES, U.S. Air Force, Avionics Laboratory, *Dayton, Ohio* 45433 (DF099740)

Develop and utilize reliability and maintainability models for comparative evaluation of proposed or existing avionic systems, subsystems or equipment, so as to increase readiness rates for the operational fleet. Apply design-to-repair concepts and guidelines so as to make existing or future avionics easier and/or less costly to repair.

Establish an avionics reliability/maintainability data base for use in developing required models and methodologies. Use this data in developing accurate field reliability prediction/testing capabilities for avionics undergoing exploratory or advanced development. Investigate the optimal use of built-in-test, modularity and other design approaches for improving avionics reliability and maintainability. Accomplish the preliminary planning for a standard, modular automatic test equipment development program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0047, SOLID-STATE RADAR DESIGN
F. LAMB, U.S. Air Force, Avionics Laboratory, *Dayton, Ohio* 45433 (DF097830)

To exploit solid-state microwave technology in combination with known radar techniques to arrive at a system concept for a complete solid-state radar transmitter/receiver configuration. This system should provide increased reliability, eliminate the size and weight of thermionic devices together with their high-voltage power supply requirements and reduce cost when compared with a conventional, mechanically scanned, air-to-ground radar system.

A multi-step analysis procedure will be used to determine the feasibility of incorporating solid-state technology into a radar system design. This analysis will include transmitter/receiver configurations implementing various radar techniques that effectively utilize the current state of the art in solid-state technology. Potential solutions will be selected from configurations in terms of cost, weight/size, availability, and future usage. The investigation will continue on potential solutions through in-house experimentation to verify overall design concept in terms of reliability, maintainability and component compatibility and the optimum design selected.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0048, COLLISIONAL EXCITATION AND IONIZATION
T.O. TIERNAN, Wright State University, Graduate School, *Dayton, Ohio* 45431 (DF041840; F44620-76-C-0007)

AF function - reconnaissance, communication, surveillance, weaponry. Deficiency - there is presently a lack of understanding of the detailed kinetics of collisional excitation and ionization processe pertinent to gas lasers, atmospheric nuclear effects and other energeti processes. Objective - investigate the kinetics, dynamics, and energy-transfer characteristics of ion-neutral and neutral-neutral collisions and determine fundamental thermodynamic properties for species of interest. How work contributes - provides significant conclusions regarding the nature of the potential surface interactions and the role of avoided crossings in low-energy ion-neutral collisions. Provides thermodynamic information on species important in the composition of the upper atmosphere. Enhances understanding of excitation processes in laser gases.

Use the ion-beam fluorescence apparatus to study energy partitioning in selected ion-neutral collisions by observing the optical emissions arising from the decay of internally excited ionic and/or neutral products. Continue studies of He /ion gases and He /halogens. Derive bond energy and electron affinity data from collision-induced dissociation reactions with emphasis on clustered ions of atmospheric species. Continue studies of the kinetics of dissociative electron attachment to XeF2 and other fluorine containing molecules as potential sources of F atoms in hybrid lasers. Crossed ion-molecular beam experiments, laser-Raman spectroscopy-flow reactor experiments and negative-ion chemical ionization experiments will be continued.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0049, LABORATORY INVESTIGATION OF RECTIFIED ALTERNATOR MODEL USED IN WEIGHT MINIMIZATION STUDY
T.A. STUART, Univ. of Toledo, Graduate School, *Toledo, Ohio* 43606 (DF049780; AF-AFOSR-3413-77)

AF function - increased electronic misssion requirements have led to the need for new airborne D.C. power system capable of delivering tens of megawatts at thousands of volts. Opportunity - one of the systems proposed to meet these requirements uses a phase controlled voltage regulator with an lc output filter in conjunction with a superconducting alternator. Since weight is a critical problem at these power levels one of the important subjects of concern is the weight of the output filter, which may weigh, even with most advanced components, several hundred pounds. Objective - it is therefore highly desirable to find a systematic design approach that will minimize the filter weight for a given set of operating conditions. Specifically this effort is to determine how the source impedance can be used to ease the requirements on the output filter. Previous analysis of the filter will be extended to include the relationship to the ac source impedance (i.e., output impedance of the alternator) since it appears that proper selection of the impedance will enable to reduce the weight of the filter and alternator, e.g., a larger value of the source impedance will tend to lower the maximum output ripple at full load and will allow the use of a small field inductance in the alternator, as well as tend to limit fault or surge currents which are critical problems with the type of loads to be used in high power supplies. How work contributes - the research provides basic criteria that will allow to minimize the weight of the filter and later of the alterna-

tor, thus rendering information which will be useful in the design of the system.

The analytical methods for determining the value of the source impedance, which will minimize output ripple and thus filter weight, as well as the computer program for calculating the minimum filter weight for a given source impedance will be experimentally tested, in conjunction with machinery available at the university, industry and AFAPL.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0050, RADAR SIGNATURES FOR AIRCRAFT IDENTIFICATION

R.A. STRATTAN, Univ. of Tulsa, School of Engin. & Phys. Sci., *Tulsa, Oklahoma* 74110 (DF047100; AF-AFOSR-3200-77)

AF function - in addition to the detection and location of airborne targets, tactical surveillance radars may someday have the capability to passively identify such targets. Opportunity - recent advances in space object identification, high-resolution radar technology, and digital data processing indicate that radar target identification may become a reality. Objective - this research will quantify effects that may be useful or may distract from the use of microwave radar signatures for target identification purposes. How work contributes - this effort will advance tactical surveillance radars for use in identification of airborne targets.

A set of 5 to 10 simple target configurations that emphasize aircraft-like scattering mechanisms will be selected, and their scattering properties will be modeled using appropriate analytical approximations. Synthetic aperature images will be formed and the results analyzed, and the resulting models will be considered for implementation on the RADC RADSIM radar simulator. Concepts and methods for further analysis and experimental verification will be developed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0051, STRONG OPTICAL SCATTERING IN ATMOSPHERIC TURBULENCE

J.R. KERR, Oregon Grad. Ctr., Graduate School, *Beaverton, Oregon* 97005 (DF049560; AF-AFOSR-3401-77)

AF function - electrooptical communications systems have defense applications which include indication and warning and weaponry. Opportunity - aberrations in optical propagation paths due to atmospheric turbulence may be corrected for if the effect of the turbulent scattering is more clearly understood. Objective - the purpose of this research is to collect and analyze detained statistical data on strong optical scattering in a well characterized laboratory medium. Results will be used to verify or modify recently developed theoretical descriptions of the scattered field as a function of all pertinent variables. How work contributes - high levels of atmospheric temperature turbulence distort electrooptical signal propagation. The phenomenon, which is not yet well understood, prevents optical systems from achieving their diffraction-limited capabilities. This project should provide a better understanding of the situation and allow improvements or compensations to be made for such optical systems.

The approach to be taken will be to construct liquid-filled scattering chamber. Atmospheric turbulence in the medium will be simulated by inserting transparent glass beads whose index of refraction is nearly that of the liquid. A low-power, highly coherent laser is intended for use as a virtual point light source with scattering measurements being made by high-resolution optical instrumentation. Data collected will include evaluation of the variance of irradiance, the detailed covariance shape, and high moments and their probability distributions as a function of strength of turbulence.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0052, TRANSPORT PROPERTIES OF ION-IMPLANTED INP

T.M. HENG, Westinghouse Electric Corp., *Pittsburgh, Pennsylvania* 15235 (DF040310; F44620-75-C-0034)

AF function - microwave solid-state electronic devices are essential components of Air Force reconnaissance, electronic countermeasures and communications systems. Deficiency or opportunity -continuing systems requirements demand improvements in power, frequency, and noise properties for high-frequency operation. InP is a promising microwave material, and control over the impurity doping profile in this material presents the opportunity of higher performance devices. Objective - the objective of this research is to investigate the utility of ion implantation in InP for the selective control of profile concentration and junction formation. How work contributes - the control and understanding of ion implantation in inp will allow for the fabrication of high-performance microwave devices requiring fine doping profile tolerances.

The approach to be used during the third year of this research involves work in the following areas - optimization of n- and p-type implants, recoil implantation and proton bombardment, and fabrication of an ion-implanted FET. Work in the area of n-type dopants (silicon and sulfur) will be based on the previous years' work and will be confined to determining optimum anneal time and temperature for maximum dopant activation and maximum carrier mobility. Difficulties have been encountered in achieving activation of p-type dopants. One suggestion is that the relative light phosphorus atoms are suffering the most damage during implant or that they are being lost from the surface. In either case, the phosphorus deficiency would account for the difficulties in p-type implants. In an effort to understand this problem the distribution of phosphorus near the surface of implanted InP layers will be studied by means of backscattering, secondary ion mass, and Auger spectroscopic techniques. If phosphorus deficiencies exist, experiments will be carried out to co-implant phosphorus and the dopant atom. High-energy proton beams will be used to recoil implant p-type dopants into extremely thin, highly doped surface layers. Proton beams will also be used to create compensated, high resistivity layers. Finally, a p-n junction InP FET will be fabricated by using n-type implantation into semi-insulating InP to form the active region followed by a p-plus implant to form the p-n gate function.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0053, DESIGN AND FABRICATION OF A THERMAL NEUTRON EXPLOSIVE DETECTOR

UNKNOWN, Westinghouse Electric Corp., *Pittsburgh, Pennsylvania* 15235 (FA77WA-3996; FA160302 (TRAIS NO.))

The contractor shall install and operate the breadboard system to obtain nitrogen content data and nitrogen density data on items at airport locations. Tests shall be conducted at a maximum of three major airports located within 1500 miles of contractor's plant. At each selected airport, a minimum of 500 pieces of luggage and a maximum of 1000 shall be tested with at least 25% containing explosive test articles.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

4.0054, INVESTIGATING WIND TUNNELS AND COMPUTERS

R.L. YOUNG, Univ. of Tennessee, Graduate School, *Knoxville, Tennessee* 37916 (DF047960; AF-AFOSR-3289-77)

AF function - aerospace vehicles. Opportunity - there is a growing feeling in the aeronautical engineering community that the conjunction of (a) current computer and information handling techniques and devices with (b) aerodynamic testing technology will effect dramatic improvement over current capability to produce useful engineering design information with either kind of system used alone. How work contributes - this effort will be a step toward building the promising interdisciplinary field between aerodynamic testing and computer technology. Objective -to explore the aerodynamic system design possibilities combining wind tunnels with computer facilities on a real time interactive basis.

Twelve young engineering faculty members will be selected to participate in a ten-week design project conducted by the contractor at AEDC, Tullahoma. A highly qualified steering committee from various universities, Air Force agencies, and NASA will

guide the project. The possibilities for advantageous joining of computers with wind tunnels will be explored.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0055, MISSILE AERODYNAMIC PARAMETERS PROGRAM
W.B. BAKER, Arnold Research Org. Inc., *Tullahoma, Tennessee* 37389 (DF420991; F40600-75-C-0001)

This project will inveatigate concepts and formulate a new approach for predicting high angle of attack aerodynamic coefficients for missile type configurations.

The coefficient prediction technique developed for the transonic speed range will be extended to the supersonic speed range. The capability for predicting coefficients for missiles with strakes at transonic speeds will be investigated with the possible addition to the prediction technique. A literature survey will be conducted to obtain existing data on maneuverable missiles.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Arnold Engineering & Development Center

4.0056, ESTIMATION OF CONFIDENCE LIMITS FOR TESTING LARGE LOGIC NETWORKS
J.L. FIKE, Southern Methodist University, Graduate School, *Dallas, Texas* 75222 (DF050010; AF-AFOSR-3461-77)

AF function - to advance the design of digital avionics systems. Important functions in growing numbers are being performed by digital systems on USAF aircraft. Deficiency - the enormously complex microprocessors that are now being fabricated on a single chip are impossible to test completely, and a methodology is required that will enable digital circuit engineers to devise extremely efficient partial-testing patterns. Objective - to derive collections of tests for microprocessors for use in acceptance testing and for maintenance in the field. How work contributes - the results of this research, if successful, would advance the reliability of on-board computers which are essential for future aerospace vehicles.

Techniques will be perfected that will quickly and accurately yield confidence limits for the probability that a network is working properly. The procedures will depend on the network and the collection of tests that have been applied. Having the confidence intervals for various tests will permit the appropriate choices of tests for maximum effectiveness.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0057, VOLUME HOLOGRAM REPRESENTATIONS OF SPACE-VARIANT OPTICAL SYSTEMS
J. WALKUP, Texas Tech University, School of Engineering, *Lubbock, Texas* 79409 (DF041420; AF-AFOSR-2855-75)

AF function - the real-time operation of the Air Force's increasingly complex weapon and command control systems will continue to require research to pursue higher throughput rates for the information processors. Opportunity - a major technology that will help meet this requirement is optical processing; however, current optical processors are limited by inflexibility in that they cannot perform nonlinear, space variant, or computational operations. Objective - this research will explore techniques for performing one- and two-dimensional space variant optical filtering. How work contributes - this effort advances optical processors for airborne and missile applications.

The work will involve the following - an investigation of the phase-coded reference beam approach to suppressing crosstalk when a number of holograms are spatially multiplexed on a thin recording medium, an examination of large-scale implementations of space-variant optical systems, a consideration of two alternatives to the sampling theorem approach previously investigated, and investigations of various techniques for synthesizing the point-spread function masks for use in a generalized one-dimensional space-variant processor.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0058, NEAR-WALL SIMILARITY IN THREE-DIMENSIONAL TURBULENT FLOWS
F.J. PIERCE, Virginia Poly. Inst. & St. U., School of Engineering, *Blacksburg, Virginia* 24061 (NSG 2301)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0059, HOT WIRE LASER DOPPLER VELOCIMETER AND MEAN MEASUREMENTS ON FLOW PHENOMENA INDUCED BY SUCTION THROUGH PERFORATED SURFACES
G.L. GOGLIA, Old Dominion University, School of Engineering, *Norfolk, Virginia* 23508 (NSG 1491)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0060, INVESTIGATION OF THE FLOW-PHENOMENA AROUND A JOVIAN ENTRY BODY UNDER CHEMICAL AND RADIATIVE NONEQUILIBRIUM CONDITIONS
S.N. TIWARI, Old Dominion University, School of Engineering, *Norfolk, Virginia* 23508 (NSG 1500)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0061, INFLUENCE OF PRECURSOR HEATING ON NONEQUILIBRIUM VISCOUS FLOW AROUND A JOVIAN ENTRY BODY
S.N. TIWARI, Old Dominion University, School of Engineering, *Norfolk, Virginia* 23508 (NSG 1492)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0062, INFRARED SCHLIEREN SYSTEM
T.D. WILKERSON, Versar Incorporated, *Springfield, Virginia* 22151 (DF035040; F44620-72-C-0076)

AF function - aerospace vehicles. Opportunity - Schlieren optical systems have long been used to make visible the density inhomogeneities in experimental gas glows, especially in supersonic wind tunnels. This technique is limited in sensitivity by the small refractive effect of air on visible light wavelengths, making it useless for observation of a number of phenomena at low overall gas density. Anomalous dispersion near resonance absorption wavelengths results in refractive index enhancement by up to two orders of magnitude. This makes it attractive to develop Schlieren and interferometric methods for infrared wavelengths in the 5 to 10 micron region, where such resonance phenomena abound for many molecules of gas dynamic interest. Objective - to demonstrate the feasibility of infrared observations of gas dynamic phenomena that could not be observed by visible spectrum methods. How work contributes - this research is directed toward the problem of infrared image recording, special sensitivity problems associated with laser focal spot size combinations of observed gases and spectral wavelength for optimum sensitivity of optical methods of flow observation depending upon index of refraction variations in the gas.

Measurements will continue on infrared refractive index and absorption surveys near available laser lines on a selection of molecular species, and flow visualization experiments, using suitable combinations of gas and infrared wavelength, will demonstrate these methods.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0063, SURVEILLANCE - PRIMARY PHOTOPROCESSES
M.W. WINDSOR, Washington State University, School of Arts & Sciences, *Pullman, Washington* 99163 (DN223328; N00014-75-C-0535)

Tunable lasers and, in particular, dye lasers are of considerable interest to the Navy for application in communication systems, in systems for underwater photography and in systems for rescuing downed naval aviators. Limited accessibility for servicing and restrictions on available space place a high premium on reliability and the overall electrical efficiency of such systems. It is the purpose of this research to find and to study short-lived, light-absorbing species in dye lasers. The data obtained will be used to recommend changes in the molecular structure of the dyes that will lead to improved laser reliability and efficiency.

The development of a single picosecond pulse laser will continue in a search for absorbing species in dyes with picosecond lifetimes. Data including thresholds, energy efficiencies, pulse energies and durations, and behavior with respect to quenchers are being obtained for selected dyes such as triphenylmethane derivatives. Performance is being correlated to molecular structure of the dyes in an attempt to obtain new, improved dye lasers.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0064, INVESTIGATION OF THE ELECTROMAGNETIC CHARACTERISTICS OF COMPOSITE AEROSPACE STRUCTURES UNDER OPERATIONAL CONDITIONS

R. BRICK, Boeing Company, *Seattle, Washington* 98108 (DN590065; N00019-75-C-0435)

To determine the effects of electromagnetic energy on aircraft composite structures and their avionic/electrical equipment and prepare operational requirements for Navy specifications.

Conduct analysis of company data on composites airframes and do the required laboratory exploratory development in areas such as bonding, grounding, shielding, etc., to develop operational parameters for avionic/electrical equipment installations. The effects of lightning, p-static, nuclear EMP, antenna EMI, electrical power returns, data signal transmission lines, grounding, shielding, bonding, and equipment EMI, will be investigated in boron and graphite composite structures.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, OPERATION OF A PAIR OF IONOSONDES NEAR MAGNETIC LATITUDE 76 DEGREES FOR STUDIES OF THE MAGNETOSPHERIC CLEFT

H.C. STENBAEKNIELSEN, Univ. of Alaska, Geophysical Institute, *Fairbanks, Alaska* 99701 (ATM76-23451)

This grant will continue the operation of the C-3 ionosondes at Sachs Harbor and Cape Parry as an International Magnetospheric Study (IMS) activity. The sounders have proven successful in determining the location of the dayside magnetospheric cleft (or cusp), and this ability has been utilized in a number of rocket, satellite and radar experiments. With the Alaskan magnetic meridional chain of magnetometer stations going into full operation in 1977, the value of the sounder data will increase. The sounders will operate approximately 4 weeks every 4 months and the data will be analyzed for the daytime location of the cleft, and its relation to other geophysical parameters. Joint experiments with other groups and the operational schedule will be kept flexible to accommodate as many experiments and special IMS periods as possible. Joint projects currently planned include a rocket launch by the National Research Council of Canada to investigate the noon-sector of the auroral oval and simultaneous cusp studies using the sounders and a new digital ionosonde being developed at NOAA, Boulder.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0002, CLOUD ANALYSIS

G.A. DAWSON, Univ. of Arizona, Inst. of Atmospheric Physics, *Tucson, Arizona* 85721 (DN123034; N00014-77-C-0099)

The objective of this research is to conduct high-frequency sampling of rain from summer cumulus for analysis of chemical constituents of the rain for the purpose of determining environmental influences on the nucleation of the cloud. This information is expected to shed some light on the rain-making process that will be of use to the naval weather forecast.

During summer shower activity, rain will be sampled every 30 seconds in prepared containers and forwarded to the chemical lab for analysis of the chemical constituents of the rain water. The analysis will include chemical content of sulphates, nitrates, nitrites, ammonia, halides, alcolai materials and some heavy metals.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0003, IR MICROWAVE CLOUD STUDY

P.A. DAVIS, S R I International, *Menlo Park, California* 94025 (DF247820; F19628-76-C-0275)

AF function - all-weather operation of tactical and strategic forces. Deficiency or opportunity - limited ability to estimate cloud conditions as a function of altitude from satellites. How development contributes - establishes how well a combination of infrared and microwave channels can improve estimates of cloud conditions based on single channels.

The spectral regions near 4 and 12 micrometers in the infrared, and 60 and 118 gHz in the microwave differ in their sensitivity to clouds. If spectral filters can be specified for each of these regions such that weighting functions for the clear atmosphere are nearly identical, then a set of equal temperatures would indicate a clear atmosphere, while unequal temperatures can be used to estimate cloud phase and altitude. Suitable spectral channels will be identified by extensive calculations of atmospheric transmittance for a great variety of potential channels.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0004, MEASUREMENT AND CALCULATION OF RATE COEFFICIENTS FOR POSITIVE ION-NEGATIVE ION NEUTRALIZATION REACTIONS

J.R. PETERSON, S R I International, *Menlo Park, California* 94025 (DF277950; F19628-75-C-0050)

AF function - nuclear weapons effects and delivery. Deficiency -radio communications and optical, infrared, and radar tracking following atmospheric nuclear detonations. How research contributes - provides rate coefficients used in computer codes for predicting atmospheric effects of nuclear detonations. Objective is determination and evaluation of rate coefficients for ion-ion recombination reactions of atmospheric species at thermal energy. Emphasis is placed on reactions involving hydrated and clustered ions.

Rate constants for two-body positive ion-negative ion recombination reactions are measured in the range of interaction energies from 0.1 to 10 eV using a merged beam apparatus. Emphasis is on hydrated and clustered ion species important in the ionosphere. Theoretical techniques are also used in determining ion-ion recombination rates and in determining the final states of species produced in these reactions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0005, DEFINITION STUDY OF PLASMA DEPLETION EXPERIMENTS DURING SPACELAB MISSION 2

A.V. DAROSA, Stanford University, School of Engineering, *Palo Alto, California* 94305 (NAS 8-32852)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0006, VERY LOW FREQUENCY PROBING OF THE MAGNETOSPHERE FROM PALMER STATION, ANTARCTICA

R.A. HELLIWELL, Stanford University, School of Engineering, *Palo Alto, California* 94305 (DPP76-82042 A01)

This is a continuation of NSF Grant Number DPP 7682024.

A very-low-frequency (VLF) receiving system will be set up at Palmer Station, Antarctica, during the austral summer of 1977/78 to obtain data on natural VLF wave activity and on the magnetospheric response to signals injected from Siple Station, Antarctica. The data taken at Palmer Station during transmissions from Siple will support ground-to-satellite transmitting experiments during the International Magnetospheric Study. During 1978 and 1979, Palmer will be paired with Siple to obtain VLF direction finding measurements. Palmer will serve as key observing station for wave-induced particle precipitation.

Three scientists will visit Palmer during the austral summer of 1977/78 to install the equipment. One of these will winter-over during 1978.

SUPPORTED BY U.S. National Science Foundation, Div. of Polar Programs

5.0007, MONTE CARLO CURRENT COLLECTION CALCULATIONS

T. SUGIMURA, Thompson Ramo Wooldridge Inc., *Redondo Beach, California* 90278 (DF248440; F19628-77-C-0020)

AF function - nuclear weapons delivery, communications, detection, track and intercept. Deficiency - lack of knowledge of ionic distributions in the atmosphere hinders construction of models for nuclear blackout conditions. Research - perform Monte Carlo flow field calculations in the transition regime, as applied to the collection of ions by rocket-borne mass spectrometers. How research contributes - a good portion of the measurements we currently make falls within the transition regime, and since both free molecular flow and continuum theories are here invalid, the Monte Carlo method is needed to describe the process of ion collection. The ultimate objective of these calculations is to aid interpretation of flight results by finding the relationship between ion fluxes to the mass spectrometer and the corresponding ambient ion number densities.

The aim of this contract is to find formulas relating the currents collected by our rocket-borne ion mass spectrometers to the undisturbed densities of ions in the ambient atmosphere with special emphasis on the collection of negative ions. The approach to this problem is to utilize the Monte Carlo simulation technique. This technique is established for neutral flow fields and heavy (ionic) charged particles and under the present contract it will be extended to include the electrons necessarily collected along with negative ions. Once a program for this simulation is developed, it will be used to calculate ion fluxes to the spectrometer for both collisionless and transitional regimes. These fluxes will be determined over the appropriate ranges of parameters (debye number, speed ratio, knudsen number, plate potential, and possible angle of attack) upon which ion collection depends.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0008, HYDRODYNAMIC MODELS OF FLARES

R.C. CANFIELD, Univ. of California, Graduate School, *San Diego, California* 92037 (NSG 7406)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0009, JOINT DEVELOPMENTAL PROGRAM IN SUPPORT OF THE ESTABLISHMENT OF A UNIVERSITIES REGIONAL APPLICATIONS PROGRAM

J.E. ESTES, Univ. of California, School of Letters & Science, *Santa Barbara, California* 93106 (NCA 2-680803)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0010, RESEARCH IN AIR POLLUTION METEOROLOGY

L.E. NIEMEYER, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (D7-0305; G603A-AK-03)

This is one of a multi-part project whose summary may be identical to others.

The research effort includes the continuing development, evaluation, and validation of air quality simulation models, both for inert and reactive pollutants. Users will be provided access to these models through the EPA User's Network for the Applied Modeling Air Pollution (UNAMAP). New concepts and technologies will be developed and adapted for improving the weakest components of existing models, with emphasis on the effects of topography, pollutant removal and conversion processes, and complex sources. Other activities will be directed toward the determination and definition of the effects of pollutant emissions on visibility, weather, and climate. Further studies will be conducted in air pollution potential climatology.

Participation will continue in the Regional Air Pollution Study (RAPS). The field portion of the study will terminate in Spring, 1977, and analysis and use of the data for model evaluation and verification will be initiated.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0011, STRATOSPHERE ANALYSIS FOR NAVAL WEATHER OPERATIONS

F. FINGER, U.S. Dept. of Commerce, Natl. Oceanic & Atmos. Admin., *Washington, District of Columbia* 20235 (DN531445; N00019-76-IP-69002)

To aid in maintaining a consistent observational system for the upper atmosphere, by establishing adjustment techniques for new data systems designed to make them compatible with the others in current use. To develop and improve methods for objective analysis of stratospheric data in support of numerical modeling efforts.

Use of statistical analysis in determining the compatibility of various kinds of stratospheric data. Use of successive-approximation method for objective analysis of synoptic data. Specifically, (1) Use objective-analysis techniques appropriate to changing circumstances. (2) For satellite overpasses nearly coinciding with radiosonde/rocketsonde launches compare radiances calculated from the latter with satellite-observed radiances. (3) Compare satellite-derived temperature profiles with radiosonde-rocketsonde profiles. (4) Apply satellite radiation data to the problems of stratospheric analysis. (5) Determine impact of satellite data on calculations of atmospheric energy.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

5.0012, METEOROLOGICAL PROCESSES (MARINE BOUNDARY LAYER PHYSICS)

W.A. HOPPEL, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN639119)

Provide new and improved capabilities to the Navy in its functions of predicting and modifying fog and rainfall. Achieve a better understanding of cloud and fog dynamics, glaciation, condensation processes, electrification, and the role of cloud condensation nuclei (CCN) in clouds and marine fog and their effects on naval operations and electrooptical systems.

Theoretical modeling, laboratory studies, and field experiments are used to determine the characteristics of natural and artificially modified clouds and fog, to identify promising areas of new research, and to develop physical principles for the design of new instruments, some of which are developed within 6.2 work units.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

5.0013, DYNAMIC IONOSPHERIC MODELING

D. STROBEL, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN220016)

Develop two- and three-dimensional models of the laminar ionosphere which will accept data from Solrad and other sensors. The object is to provide the information needed to predict the ionospheric effects on ionospherically propagated systems.

Multi-dimensional reactive flow MHD computer codes that solve the equations of motion of a chemically reactive compressible fluid in a magnetic field will be used to study the response of the ionosphere to the deposition of solar radiation. New data on the composition of the ionosphere will be incorporated, and its influence evaluated. A global model with transient effects will be developed, with the appropriate chemistry incorporated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

5.0014, SOLAR OCCULTATION EXPERIMENTS WITH THE NIMBUS G/SAM AND AEM-B SPACECRAFT SENSORS
G.W. GRAMS, Georgia Inst. of Technology, Graduate School, *Atlanta, Georgia* 30332 (NSG 1493)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0015, REMOTE SENSING OF AGRICULTURE, EARTH RESOURCES AND MAN'S ENVIRONMENT
D.A. LANDGREBE, Purdue University, School of Engineering, *Lafayette, Indiana* 47907 (NAS 9-15466)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0016, VIKING GUEST INVESTIGATOR PROGRAM
UNKNOWN, Univ. of Massachusetts, Graduate School, *Amherst, Massachusetts* 01002 (NAS 1-15162)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0017, ELECTRON DENSITY PROFILES APPLIED TO SATELLITE DETECTION/ NAVIGATION
R.S. ALLEN, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249120)

AF function - advanced radar and navigation systems. Deficiency -the ionosphere introduces errors in range, angle and timing in the spadats tracking radars, in deep space detection and surveillance radars and in planned navigation systems. Objective - to develop algorithms and techniques for ADC radars so as to reduce system errors caused by the ionosphere. How research contributes - improves the accuracy of radar tracking and navigation systems by developing algorithms and correction procedures. Makes use of on-site measurements and scale factors from worldwide observations collected by Air Force Global Weather Central to specify and update predictions of expected range, angle and timing errors.

Investigate dependence of errors in range, angle and time on the principal parameters of electron density profiles. Develop statistical relationships to predict these from climatology. Develop and validate computer algorithms to use on-site measurements of ionospheric parameters which are useful for real-time and post-event correction to radar and navigation systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0018, PHYSICS OF THE SOLAR ATMOSPHERE
R.C. ALTROCK, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249430)

Objective - AF function - communications, surveillance, detection, tracking. Deficiency - inadequate warnings of sun-induced disruptions of AF communications and detection systems. Objective - determine the environment for solar activity and improved predictions of geophysical disturbances. How research contributes - this work unit addresses the basic processes that lead up to solar flares and seeks an understanding of these mechanisms. This understanding is needed to provide accurate and timely forecasts of solar activity for AF systems that depend upon the propagation of electromagnetic energy.

Mechanisms responsible for the sun's activity originate deep within the sun where magnetic fields are generated by large-scale material motions. These mechanisms, which are poorly understood, are believed to lead to the formation of coronal holes, and solar flares, and subsequent geophysical disturbances which affect Air Force communications and surveillance systems. Observational and theoretical studies of these phenomena will be undertaken. Definitions of the basic magnetic field configuration and energy transport will be attempted using as tools the diode array and universal birefringent filter at the vacuum tower telescope. Comparisons between observed magnetic, convective, and radiative field configurations will be made against theoretical models of energy transport in both the quiet and disturbed regions of the solar atmosphere. A search will be undertaken for large-scale convective motions (giant cells) on the sun, and if they are found, their relations to solar activity will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0019, MAGNETIC SIGNATURES AND INDICATORS
P.F. FOUGERE, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249260)

AF function - operation of systems for communication, surveillance, guidance and navigation. Deficiency - system performance is degraded at times of severe geomagnetic disturbances when there are extreme departures from the normal conditions in the propagation environment. Objective - incorporate measurements from a mid-latitude magnetometer network into a method for specifying the onset and intensity and eventually forecasting geomagnetic disturbances. How research contributes - development of methods for forecasting geomagnetic disturbances will enable system operators to take appropriate measures to lessen the impact of such disturbances on military operational capability.

Measurements from a mid-latitude network of magnetometers will be used to investigate the magnetic variation signatures and micropulsation activity associated with geomagnetic disturbances. A magnetic activity index will be developed from the data by determining the diurnal variations at each station that result from quiet ionospheric current systems. Once these variations are known, accurate measurements of magnetic disturbances can be made at each station and combined to yield in real-time an index that correlates well with the kp index. The mid-latitude signatures of geomagnetic disturbances will be studied for a number of specific events when additional data are available from satellite and airborne instruments. A characteristic signature would define the onset, time development, and intensity of disturbances. Geomagnetic micropulsations measured by the network should be sensitive indicators not only of geomagnetic activity, but of the overall configuration of the magnetosphere and the processes that may precede a disturbance. The diurnal characteristics of micropulsations will be analyzed from daily spectrograms of the data showing the time behavior of the frequency and intensity of activity. A knowledge of the characteristics of micropulsation activity for both quiet and disturbed times will make it possible for network observations to be used for forecasting purposes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0020, STRATOSPHERIC DYNAMICS
R.E. GOOD, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF244810)

AF function - environmental impact statements of high-altitude Air Force operations. Deficiency - current or anticipated Air Force operations in the stratosphere may deposit harmful material and it is important to be able to assess the dispersion and residence time of such material in the stratosphere. Research - the necessary high resolution techniques for measuring turbulent transport and lifetime will be developed and tested on balloon platforms. Models of aircraft and missile wake dispersion will be developed. How research contributes -models will be developed from the experimental observation to predict the dispersion, spreading and lifetime of aircraft and missile exhaust products in the stratosphere.

In order to obtain experimental data on possible turbulence, three main techniques are employed: (a) chemical smoke trails formed vertically by rockets which give the vertical profiles of horizontal winds, (b) balloon-borne sensors giving temperature and microscale vertical wind components (and, in general, 3-d winds) and (c) aircraft wake studies. The resulting data (consisting for the most part of time lapse photographs from several locations simultaneously) are triangulated and measured (assisted by several computerized data reduction techniques) and these data are further reduced to give wind shears, Richardson numbers (criteria for turbulence instability) and energy spectra (giving turbulence information). The resulting estimates of the vertical turbulent transport effects will be fed into dynamic models in order to learn the expected impact from vehicle emissions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0021, OBJECTIVE VISIBILITY FORECASTING TECHNIQUES

W.S. HERING, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF243910)

AF function - launch and recovery of military aircraft. Deficiency - inadequacy of present short-range forecasts of airfield visibility. Objective - develop and evaluate objective visibility forecasting techniques using space-time correlation and translation vector concepts applied to automated observations from a dense network of stations near the airfield. How development contributes - the launch and recovery of military aircraft can be made more effective and less hazardous when adequate warnings of low visibility conditions are forecast.

Objective forecast aids are necessary to rapidly screen the vast amount of data generated by the mesonetwork in order for the forecaster to be able to predict rapid changes in a timely and efficient manner. Data gathered from the mesonetwork will be thoroughly analyzed to reveal space-time correlations, pattern translation vectors, and other derived quantities which prove to be effective predictors. Objective forecast techniques will be formulated with output in probabilistic terms and tested on independent data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0022, AEROSOL LABORATORY AND FIELD STUDIES

F.E. VOLZ, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF244300)

AF function - target acquisition and tracking reconnaissance. Deficiency - the performance of optical systems observing through the atmosphere is significantly degraded by absorption and scattering by aerosol particles. Objective - measurements of absorption and refractive index of natural aerosol substances from tropical and continental climates, in the visible and IR spectral range. Measurement of scattering function of nonspherical particles. How research contributes - results will be applicable to the solution of such problems as atmospheric contrast reduction, sky background radiance, propagation breakdown and out of beam scattering of laser radiation. Models of atmospheric transmittance will become more realistic.

Sufficient amounts of aerosol substance are being obtained worldwide by evaporation of precipitation and from high-volume air filters. The aerosol substance are separated into dust, soot, and water solubles, and the latter fractionated into inorganic and organic (alcohol and benzene soluble) constituents. In some cases, large and small aerosol particles will be collected separately. Collections will be made by the C-130 project aircraft at altitudes up to 7 km. Absorption spectra of dry substance can be measured by the KBR disk method from 0.25 to 40 microns, and the real part of the refraction index from reflection of disks of pure aerosol substance. Results are to compare with chemical analysis. Experimental problems with the KBR method are to be clarified and comparison of optical measurements on aerosol directly deposited on a substrate are to be made.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, DIRECT OBSERVATIONS OF SOLAR PARTICLES AFFECTING THE COMMUNICATIONS ENVIRONMENT

K.G. YATES, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF248900)

AF function - survivability, solar effects on satellite and missile operations, detection, surveillance, and communications. Deficiency -inability to satisfactorily describe and accurately predict solar and precipitation particle events which affect the aerospace environment in which USAF systems operate. Objective - provide direct and timely information on the energetic particles, primarily protons, which approach or enter the AF spacecraft and communications environment. Develop techniques for near real-time processing of these data for use as input for solar forecasting. Add data to the data base or catalog of events in order to better define the environment and to add to our understanding of the physical processes involved. During FY77 the Solrad 11 satellite will be the basis of the observational program. Improved instrumentation will be developed for future satellites. How research contributes - will provide solar particle data required for definition of aerospace environment. In addition to providing data to environmental forecasters, data will be analyzed to identify critical parameters required to improve the definition of the aerospace environment and the effects of solar radiation on it. Energetic particles accelerated at the sun propagate through the interplanetary medium, impinge on the atmosphere and significantly affect the e.m. propagation via the ionosphere. Current knowledge and prediction techniques are insufficient to accurately predict solar particle outbursts and their effects on the aerospace environment.

Satellite-borne instrumentation has been designed and is providing solar-particle observations which will be analyzed to identify critical parameters required to improve the definition of the aerospace environment and the effects of solar radiation on it. The data will also be made available to environmental forecasters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0024, IONO-MAGNETIC STORM/TROUGH STUDY

M.J. MENDILLO, Boston University, School of Engineering, *Boston, Massachusetts* 02215 (DF243190; F19628-75-C-0044)

AF function - advanced radar and satellite ranging-navigation systems. Deficiency - magnetic storms produce large departures from median ionospheric time delays in operational and planned systems. Research - develop and test models and theories of behavior of total electron content (TEC) - time delay during magnetic storms using actual TEC data from stations along western Atlantic covering latitudes from polar to equatorial regions. How research contributes - improve navigation and satellite detection radar systems ranging accuracy by developing models and methods of improving predictions of time delay produced by the ionosphere during magnetic disturbances.

Using actual data available along the eastern North American continent study the effects of magnetic storms on the behavior of TEC, NMAX and slab thickness as a function of all parameters available during those periods. Construct computer models of behavior of these ionospheric parameters during magnetically disturbed periods for systems operational use. Study the correlation of ionospheric parameter changes along this latitude chain on a day-to-day basis to determine the day-to-day variability of the ionosphere. Present results in form useful for incorporating corrections to systems for ionospheric time delay errors, by constructing algorithms to represent this variability.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, IMPROVED ROCKETBORNE PZL DENSITOMETER PAYLOADS

D.H. FRYKLUND, Accumetrics Corporation, *Cambridge, Massachusetts* (DF247210; F19628-76-C-0129)

AF function - airborne surveillance and weapon delivery. Deficiency - improved accuracy required for low-altitude satellite ephemerides and impact prediction for operational AF RV's and weapons systems. Research - rocketborne instrumentations and improved telemetry for accurate density measurements in 50-150

km range. How research contributes - density data in this altitude range can contribute to improved impact prediction capability for ICBM's, RV's and improved ephemerides computational accuracy for low-altitude satellites and improved model atmosphere values.

Upgrade PZL densitometer performance (accuracy and reliability) by applying necessary design and engineering modifications based upon system analysis and inputs derived from analyses of flight data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0026, IMPROVED ROCKETBORNE PZL DENSITOMETER PAYLOADS

D.H. FRYKLUND, Accumetrics Corporation, *Cambridge, Massachusetts* (DF249630; F19628-77-C-0163)

AF function - airborne surveillance and weapons delivery. Deficiency - improved accuracy required for low-altitude satellite ephemerides and impact prediction for operations af rv's and weapons systems. Research - rocketborne instrumentation and improved telemetry for accurate density measurements in 50-150 km altitude range. How research contributes - density data in this altitude range can contribute significantly to improved impact prediction capability for ICBMS, RVs, increased computational accuracy for satellite ephemerides and improved mode atmospheres that result from an increase in the density data base.

Work to be performed on this contract will consist of the development, fabrication and testing of operational rocketborne falling sphere instrumentation that will enable atmospheric density to be determined with improved accuracy in the altitude region between 50 and 150 km. In addition the work will include system analysis based upon previous flight results. This will provide an opportunity for in-depth evaluation of flight performance in order to attain improved reliability and survivability. Rocketborne density payloads using hardware developed under this contract will be launched at selected sites in accordance with AF programs and requirements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0027, PHOTO IMAGE ANALYSIS

I.L. KOFSKY, Photometrics Incorporated, *Lexington, Massachusetts* 02173 (DF261290; F19628-76-C-0239)

AF function - environmental impact statements of high-altitude Air Force operations. Deficiency - current or anticipated Air Force operations in the stratosphere may deposit harmful material and it is important to be able to assess the dispersion and residence time of such material in the stratosphere. Research - models of aircraft and missile wake dispersion will be developed. High-resolution techniques for measuring turbulent transport and lifetime will be developed and tested on balloon platforms. How research contributes - models will be developed from the experimental observations to predict the dispersion, spreading and lifetime of aircraft and missile exhaust products in the stratosphere.

Photographic and other optical observations of tracers in the stratosphere provide brightness data which are reduced by isodensitometry. Interpretation of the reduced data permits derivation of wind shears, energy spectra and Richardson numbers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0028, ANALYSIS OF ATMOSPHERIC SENSOR DATA

M. SCHNEEDERGER, R D P Incorporated, *Waltham, Massachusetts* (DF248190; F19628-77-C-0167)

AF function - communications, surveillance and navigation in the upper atmosphere. Deficiency - lack of knowledge of disturbed ionosphere for possible circumvention. Research - analysis of experimental data from rockets flown through various categories of quiet and disturbed ionosphere. How research contributes - augments knowledge on the prediction of radio wave propagation with emphasis on the polar regions. Data obtained from rocketborne experiments such as electron and ion density, temperature, electron energy distribution, vehicle potential in the d and e regions during varying conditions are analyzed leading to tabular results of the critical parameters upon which avenues of advanced analysis can be taken. The first order results of the data analysis have as outputs plots and digital tapes.

Develop and implement computer routines and techniques for the continued reduction of raw digital data from transducer output requiring correlated sensor position vectors in their analysis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0029, FEASIBILITY OF USING LANDSAT SPECTRAL DATA FOR ACQUISITION OF TERRAIN INFORMATION FOR MULTIPLE PURPOSES

H.W. WEST, U.S. Army, Waterways Experiment Station, *Vicksburg, Mississippi* 39180 (DA0P8181)

The objective of the research is to determine the feasibility of using LANDSAT data to obtain terrain data on soils, geology, vegetation, and water bodies as related to military planning and operations.

There is a dire need for terrain data and related terrain information (land use maps) on areas of interest to the military such as the Middle East and Europe. In most cases very little, if any, quantitative terrain data and conventional aerial and ground photography are available for obtaining performance estimates for selected materiel systems. The LANDSAT sensor systems provide radiance measurements for four spectral bands. Computer-compatible tapes of the radiance data and enhanced imagery produced from these values will be used to determine the feasibility of delineating the distribution of terrain conditions within selected study areas. The radiance data for three periods, representing fall, summer, and winter conditions, will then be correlated with ground truth data. Two reports will be published on the study.

SUPPORTED BY U.S. Dept. of Defense, Office Chief of Engineers, Corps of Engineers

5.0030, APPLICATION OF AERIAL MULTISPECTRAL TECHNIQUES FOR QUANTITATIVE DETERMINATION OF TURBIDITY

M. DOCKTER, U.S. Environ. Protection Agcy., Remote Sensing Division, *Las Vegas, Nevada* 89114 (J620A-43)

OBJECTIVE: Determine the feasibility of using aerial multispectral techniques for remote sensing of sediment in water.

APPROACH: a) Simultaneously collect ground truth data and multispectral data from an airborne platform at various altitudes and several data sites to allow studies for atmospheric attenuation correction and site-to-site algorithm transferability. b) Perform analysis and compile a report of results obtained using data collected above and compare to EPA standard laboratory testing methods.

CURRENT PLANS/PROGRESS: a) Collect ground truth and multispectral data (completion, 9/77) b) Perform analysis and compile report (expected completion, 12/77).

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Support Lab.

5.0031, VHF - UHF DEEP FADING

A. BUSHBY, Geophysical Institute of Peru, *Lima, Peru* (DF245970; AF-AFOSR-2885-76)

AF function - communications, radar. Deficiency - signal fading causes high error rates in communications, loss of signatures in radar identifications. Objective - to determine and predict effects of the equatorial ionosphere on signals transmitted by satellites. How research contributes - predicts and maximizes message reliability. This work continues VHF, UHF and L band observations in Peru. The work will be extended to include observations at (Negritos) a site displaced from the geomagnetic equator of scintillation and total electron content. additional support

will be given the AFAL/AFGL flight test program of communications satellite operation in the equatorial zone.

VHF and UHF satellite signals will be observed at three locations in Peru, and L band signals at one location. These will be supplemented by radar observations and will support on-board observations using AFAL and AFGL aircraft of the LES 8/9 satellites in order to establish communications characteristic of the equatorial ionosphere. This work continues to support the AFSATCOM II program and the AFGL/AFAL equatorial flight test programs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0032, VIKING GUEST INVESTIGATOR PROGRAM
UNKNOWN, Univ. of Texas, Graduate School, *Austin, Texas* 78712 (NAS 1-15164)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0033, STUDY OF THE DYNAMICS OF OCEAN SURFACE CURRENT AND KUROSHIO CIRCULATION
T. ICHIYE, Texas A & M University System, School of Geosciences, *College Station, Texas* 77843 (NAS 6-2884)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0034, APPLICATIONS OF HEAT CAPACITY MAPPING MISSION SATELLITE DATA TO STUDY URBAN HEATING PATTERNS
UNKNOWN, Texas A & M University System, Graduate School, *College Station, Texas* 77843 (NAS 5-24383)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0035, RETARDING ION MASS SPECTRONOMETER FOR DYNAMICS EXPLORER
UNKNOWN, Univ. of Texas, Graduate School, *Dallas, Texas* 75230 (NAS 8-32831)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0036, VIKING GUEST INVESTIGATOR PROGRAM
UNKNOWN, Univ. of Virginia, Graduate School, *Charlottesville, Virginia* 22903 (NAS 1-15160)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0037, LIDAR INVESTIGATIONS OF RAIN
J.A. WEINMAN, Univ. of Wisconsin, School of Letters & Science, *Madison, Wisconsin* 53706 (ATM76-21304 A01)

The objective of this research is to seek additional information on rain by means of monostatic lidar remote measurements over what can be obtained by radar and rain gauges. A lidar system which will be able to measure Raman scattered returns at close range and which will also be able to measure the effective extinction coefficient of rain as a function of receiver field of view will be developed. The combination of these measurements will permit the evaluation of multiple scattering and perhaps provide information on the raindrop size distribution. This lidar system will also display data in range height indicator and plan position indicator formats which will facilitate the investigation of rapidly changing rainfall structure.

The quantitative measurement of rainfall using radar alone is difficult; however, a radar operating in conjunction with a lidar could provide a better measurement of rainfall. The lidar system will be operated with radar and rain gauges for the purposes of quantitative intercomparison.

A theoretical investigation of the scattering of laser pulses from large raindrops will be pursued. The effects of multiply scattered lidar pulses in rain showers will be modeled. The uniqueness of extinction coefficients derived from multiply scattered lidar returns will also be investigated. This is important research in view of the need for better understanding and quantifying rainfall processes with regard to food production and weather modification.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, EVALUATION OF VISUAL DISCRIMINATION PRETRAINING
B.J. EDWARDS, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF222210)

To investigate the effectiveness of specific training methodologies in training the essential visual discriminations required to perform the final turn of the normal landing pattern and to develop a set of audiovisual training materials which will provide training for student pilots in these visual discriminations.

An iterative training product development cycle will be employed to develop audiovisual materials for use in training of the visual discriminations. Instructional systems development (ISD) procedures and methodologies from the fields of educational technology and educational psychology will be employed. The effectiveness of experimental training materials in imparting visual discrimination skills will be empirically validated and then evaluated by executing the final turn in simulated and real time environments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0002, F-4E MODEL/PROBE VISUAL SYSTEM APPLICATION
P.E. GRUNZKE, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF221100)

The purposes of this effort are: (1) to evaluate the logicon automated flight training system (afts), and (2) to evaluate the utility of a model/probe visual system in f-4e training.

As directed by the usaf air staff, tac and afhrl/ft are developing a utilization concept for f-4e wsts no. 18. The simulator system is being refurbished at singer-link, with a six-degree-of-freedom motion system and a model/probe visual system. Upon completion, the system will be installed and an evaluation of the training utility of the device will be conducted. The logicon afts will be evaluated using f-4e wsts no. 15.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0003, VISUAL CUE UTILIZATION DURING FLIGHT
W.D. LEMASTER, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF223260)

To determine the extent to which available visual cues are utilized by pilots in the performance of flight maneuvers learned in undergraduate pilot training (UPT), to determine the methods of perception (fixation or peripheral) of visual cues, and to investigate eye movements by expert pilots during landing and other maneuvers.

The initial data for this study were collected by instructor pilots wearing the helmet-mounted NAC eye mark recorder in T-37 aircraft flights under WU 1123-01-10. Assessment and evaluation of the filmed and video-taped eye movement data will determine whether or not consistent patterns of visual cue utilization occur. If such patterns can be detected, they will form the basis for the development of improved training methods for UPT.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0004, ISOLATION OF BIOASSAYABLE GROWTH HORMONE FROM INCUBATED PITUITARY GLANDS
M. SPENCER, Univ. of California, Graduate School, *San Francisco, California* 94122 (NCA 2-665804)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0005, GENERAL DEVELOPMENT OF HZE PARTICLE DOSIMETRY
E.V. BENTON, Univ. of San Francisco, School of Science, *San Francisco, California* 94117 (NAS 2-9845)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0006, THE VALIDITY OF VARIOUS MEASURES IN PREDICTING PILOT TRAINING PERFORMANCE
J.M. KOONCE, U.S. Air Force, Behav. Sci. & Leadership Dept., *Colorado Springs, Colorado* 80840 (DF281710)

AF function - use of psychomotor tasks for pilot trainee selection and UPT attrition reduction. Deficiency - the attrition rate in UPT is unacceptably high because of the soaring costs of carrying a pilot trainee only part way through upt. Research - the research will evaluate the use of tracking devices and low-cost simulators as predictors of success in UPT. How research contributes - the results of this research can be applied to pilot trainee selection to reduce flying deficiency attrition. Additionally, the low-cost selection devices investigated would not make an appreciable increase in the cost of selection while improving the accuracy of selection methods. Abstract - T-41 candidates will perform a two-axis tracking task with and without side-task loading. Results will be correlated with T-41 success, and the success of a later group of T-41 candidates will be predicted from their results on the tracking tasks. The predictive validity of the tracking task will be determined by the actual T-41 performance of the second group. A similar program using GAT-1 performance measures will be performed to furnish validation data for the selection efforts of HRL/PE.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Frank J. Seiler Research Lab.

6.0007, THE MEANING OF COMPLEXITY OF FLIR DISPLAYS - POTENTIAL FOR SCALING AND APPLICATION
S. GROOT, State University of Fla. Sys., School of Technology, *Miami, Florida* 33199 (DF047610; AF-AFOSR-3242-77)

AF function - electrooptical sensor systems are evolving with newly emerging Air Force airborne system technologies. Observation, interpretation, perceptual integration, decision making, and skilled motor responses to displayed electrooptical sensor information may be required of a sensor operator during flights at very high speeds and very low altitudes. Deficiency - while engineering aspects of sensor simulation technology are advancing at a rapid pace, the behavioral aspects are seriously lagging behind. Objective - basic data on human performance in response to low light level television (l3TV) and forward looking infrared (FLIR), electrooptical sensor displays is needed to provide a technical information data base for simulation applications to help reduce Air Force in-flight training significantly by 1981. How research contributes - provision of a data base concerning the psychological and perceptual cueing simulation necessary and sufficient for positive transfer of training before and during simulator development will help assure the achievement of cost-effective simulation fidelity.

The complexity of still l3TV and FLIR scenes will be scaled. Specific scenes will be selected for computer image generation (CIG) simulation so that several computer parameters can be varied for comparison purposes. The major visual and physical factors associated with subjective complexity for CIG applications will be determined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0008, DEVELOPMENT AND PREPARATION OF USER-ORIENTED DOCUMENTATION
D.B. WORTMAN, Pritsker & Associates, *Lafayette, Illinois* (DF318420; F33615-76-C-5012)

To obtain suitable techniques for modeling and analyzing manned military systems. The present work represents the fourth and final effort in the development of SAINT (systems analysis of an integrated network of tasks). Completion of this project will enable computer simulation of man-machine systems at all levels of complexity. Such simulation will be useful to systems designers and human factors engineers for assessing alternative configurations of man-machine systems, in terms of total system performance, for a wide variety of military applications.

The current SAINT effort will complete the development of basic capabilities, consolidate the advances made previously, and prepare user-oriented documentation of the modeling technique and associated analysis program. While some new program development is indicated, a large part of the programming tasks is directed to the refinement or modification of existing capabilities and the deletion of outmoded or unnecessary subprograms/procedures. Considerable attention is to be given to the preparation of user-oriented documentation suitable for self-paced instruction in the use of the modeling technique and the associated computer programs for model analysis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0009, TASK LOAD AND OPERATOR ATTENTION CAPACITY IN TIME SHARING PERFORMANCE
D. GOPHER, Israel Inst. of Technology, *Haifa, Israel* (DF046760; AF-AFOSR-3131-77)

AF function - as the role of the pilot is shifting from a direct controller of aircraft functions to a monitor and decision maker in a complex, dynamic, and intelligent man-machine system, a requirement has emerged for the measurement of abilities that support this new role. Deficiency - the increasing complexity of flight missions combined with the growing sophistication of airborne systems and the concurrent increase in production and training costs have emphasized the need for improved techniques in the assessment of pilot attention capacity and task load. Objective - the research activity will follow three major lines -- /a/ development of quantitative assessment and time sharing efficiency, /b/ training for time sharing, and /c/ development of software package, including feedback devices and adaptive techniques. How research contributes - improved techniques and prediction equations for the evaluation of task load and operator efficiency in time sharing situations will be utilized in system design and development.

It is proposed to incorporate major classes of tasks in a cross-matrix design that will examine the interrelation between the tasks and the appropriateness of the methodological approach in quantifying performance and manipulating demands.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0010, MODELLING TRANSIENT MOTION CUE EFFECTS
A.M. JUNKER, Bolt Beranek & Newman Inc., *Cambridge, Massachusetts* 02138 (DF320790; F33615-77-C-0506)

At AMRL-EM, an extensive research program is being pursued to investigate motion-related performance of the pilot (human operator). This effort includes basic studies to determine (a) how pilots utilize motion-related sensory cues in real or simulated flight and (b) how this aspect of pilot response behavior can be included in models for pilot/vehicle systems. Bacause many tracking tasks of interest to the military (e.g., air-to-air combat) are nonsteady state, the pilot model must be applicable for transient, as well as steady-state, maneuvers. therefore, the objective of this work unit is to investigate the effects of motion in non-steady-state tracking situations. The present Bolt, Beranek and Newman, Inc., (BBN) pilot model contains features needed to ex-

plore the various aspects of motion cues in transient tasks. Therefore, BBN's assistance will be utilized through this work unit.

A program to explore the pilot's use of motion cues in transient aircraft maneuvers will be performed. BBN will assist in the validation of a model concerned with the pilot's use of motion dues during transient aircraft maneuvers. This analytic study will be correlated with an ongoing experimental study at AMRL/EM.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0011, PROTECTION OF THE CARDIOPULMONARY SYSTEM AGAINST THE INJURIOUS EFFECTS OF ACCELERATION

P.A. CHEVALIER, Univ. of Minnesota, School of Medicine, *Rochester, Minnesota* 55901 (DF032170; F49620-76-C-0001)

AF function - aircrew members may be exposed to high, sustained, rapid-onset, gravitational forces in present and planned aircraft. The lungs and associated structures are particularly vulnerable to acceleration stress with resultant operator performance degradation and incapacitation. Deficiency - increased knowledge of the mechanical characteristics and dynamic geometries of the lung is needed to understand the factors which determine man's reaction and tolerance to changes in the force environment. Objective - techniques for measuring tissue positions plus algebraic reconstruction will be used. How work contributes - understanding of the processes involved should lead to development of efficient means of combating the effects of extreme changes in gravitational-inertial force environments. This research supports ongoing AMD programs and has applicability to the civilian sector.

The work will use the parenchymal marker technique to study the dynamic spatial distribution of lung parenchymal strains and using the cross-section reconstruction techniques will study the dynamic geometry of the respiratory system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0012, INDIVIDUALIZED OXYGEN DELIVERY SCHEME

E.A. PATRICK, Univ. of Cincinnati, Graduate School, *Cincinnati, Ohio* 45221 (DF319700; F33615-77-C-0603)

The contractor is to identify and select several physiologically sound schemes for enhancement of an ideal oxygen delivery process that will provide the individual crewmember with physiologically adequate amounts of oxygen while simultaneously ensuring optimal oxygen supply conservation. An accurate, reliable methodology, convertible to lightweight hardware at a later date, must be continuously changing flow demands imposed by the airborne crewmember during various exposures of acceleration, altitude, and workload.

The eventual remedy to current hardware limitations must be based on development of alternative methodologies for oxygen delivery that can later be implemented with hardware fabrication. The starting point for this effort, to be detailed in this statment, should consist of: (1) nomination and theoretical evaluation of candidate concepts for matching instantaneous oxygen delivery with crewmember demand, (2) mathematical simulation of the two most promising schemes, as chosen by a panel of physiological investigators currently active in aerospace medicine endeavors. This suggested approach is necessarily contingent on respiratory property and response data that is available from qualified sources. The end product of this effort is expected to be a functional, physiologic-based scheme for accurately controlling the inflight delivery of oxygen, with maintenance of optimal crewmember performance serving as the guiding criterion.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0013, CARDIOVASCULAR, RENAL AND RESPIRATORY EFFECTS OF HIGH-INTENSITY, INTERMEDIATE-DURATION, LOW-FREQUENCY VIBRATION

R.M. NEREM, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (DF036870; AF-AFOSR-2526-73)

AF function - Air Force operational personnel are subjected to a number of environmental stresses, one of which is vibration. With increasing numbers of missions in high-performance aircraft at low altitudes, crew members will be exposed to increased quantities and durations of low-frequency vibrations. Deficiency - the circulatory system is one of the mammalian systems most affected by vibration - of particular interest is the influence of vibration on the transport of certain blood elements to and across the vessel walls and the effects of renal function. For example, if cholesterol transport to the arterial wall is enhanced and/or if renal function is impaired this would have significant implications on long-term health problems of exposed personnel. Objective - this effort will investigate the interaction between the physiological and fluid mechanical phenomena associated with whole body sinusoidal vibrations. How work contributes - this research supports objectives identified in AFSC RO 1.6 mechanical force environments and RO 1.7 aerospace medicine.

Three specific tasks have been identifed. Hot-film constant temperature anemometer measurements of aortic blood velocity will be continued in an attempt to better map out the extent of vibration-induced changes in the circulatory systems's hemodynamic characteristics. The pulsed ultrasonic Doppler velocimeter unit developed during the past year will be applied in the study of whole-body vibration effects. Studies of regional blood flow using radioactive microspheres will be continued to determine the relative role of transendothelial transport versus vasa vasorum perfusion in the movement of albumin into the aortic wall.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0014, ANALYSIS OF AERODYNAMIC DECELERATION INJURIES DURING EMERGENCY ESCAPE

C.F. ACEVEDO, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321450)

Injuries caused by aerodynamic deceleration during emergency escape from high-performance aircraft using open ejection seats are a serious problem under non-combat conditions and a major combat ejection problem. These injuries, which may be life-threatening at their onset, also increase the possibility of fatality in final phases of escape, i.e., parachute opening shock, descent, landing impact, post-escape survival and rescue. Aeromedical criteria must be established to support development of protective equipment. The objective of this effort is to: (1) provide medical descriptions of operational injuries, (2) determine the injury mechanisms, (3) establish a basis for prioritizing biomechanical research on this problem and (4) provide aeromedical criteria for injury prediction models and protection techniques.

All accident reports from 1965 to present in which there is a possibility of injury from aerodynamic deceleration will be reviewed in detail. The review, accomplished in collaboration with the Deputy Inspector General for inspection and safety, will include analysis of ejection conditions, Flight Surgeon's evaluation of injuries, X-rays and long-term effects of the injuries. Injuries occurring during the investigation will be studied directly on a physician-to-physician basis. Research results will be made available to the Naval Air Systems Command as well as USAF laboratories and product divisions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0015, BIODYNAMIC CRITERIA FOR DEVELOPMENT AND EVALUATION OF LIFE SUPPORT SYSTEMS

J.W. BRINKLEY, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF322780)

The Life Support Systems Program Office of the Aeronautical Systems Division conducts a research and development program to provide an integrated assemblage of components, techniques and training required to assure aircrews and their passengers the best possible flight environments for conducting combat and peacetime Air Force missions. This effort includes provision of safe and reliable escape, descent, survival and recovery in emergency situations. The objective of this work unit is to provide aeromedical design criteria for the development and evaluation of

life support systems such as emergency escape systems, personnel restraint systems, and flight helmets. Biotechnology data are applied to insure aircrew safety within the transient mechanical stresses associated with emergency flight conditions, e.g., ejection acceleration, aerodynamic deceleration, aircraft crash, etc.

Technical support is provided on specific life support systems programs in response to letter requests and memoranda of agreement submitted to the Aerospace Medical Division by the Life Support Systems Program Office. Support includes analysis of escape system designs to assure adherence with biodynamic design criteria, development of design criteria for new protective systems, assessments of current operational problems, and test and evaluation of developmental systems. The ASD helmet test facility is operated and maintained under this work unit. Technical consultation is also provided on the development of the high-technology ejection seat.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0016, DISPLAY/OBSERVER INTERFACE FOR TARGET ACQUISITION AND WEAPON DELIVERY

F.E. GOMER, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF320980)

This effort will translate basic visual performance metrics into design criteria for visual display systems. An overall descriptive model will be developed which relates the ability of an observer to acquire and process visual information on imaging and symbolic display devices. this model will take into account the combined effects of display image quality, task criteria, loading, and environmental stressors (vibration, acceleration, etc). In turn, this model will be utilized to establish design criteria for real and virtual image idsplay devices for specific operator information requirements in mission functions such as air-to-air and air-to-surface target acquisition and weapon delivery. Display/ observer interface deficiencies will be determined and used to guide further development and refinement of CRT, matrix element, real and virtual image display technology. The products of this effort will include: (1) an overall unitary image quality metric describing the correlation between display image quality and operator performance, (2) MIL STD for imaging quality of virtual and real image/symbology displays, (3) display design handbook. This effort supports AFSC development goals TC-1, TC-7, C3-3, and MS-4 and the tri-service panel on night vision technology.

This effort combines the products of other work units which describe the visual processes in the perception of displayed information (task 718404) and observer performance based upon measures of display imaging quality in order to develop an overall observer/display interface model. Aspects of the observer's capability, display quality and image content will be relatable utilizing a sine wave response construct. Two-dimensional transform space modeling techniques will be employed to describe the elements of the information channel between the display and operator. This model will be refined and extended to include aspects of cognitive processes based upon information content within the display imagery. The visual-evoked response and visual search behavior will be applied as tools for measuring the combined effects of display context (image quality) and content (scene complexity).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0017, EXPERIMENTATION IN ROLL AXIS WASHOUT EFFECTS

A.M. JUNKER, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF317870)

The objective of this work unit is to perform experiments on the roll axis tracking simulator (RATS) using various washout schemes and collect human performance data which will be used for modeling purposes under work unit 6893-02-25.

Under work unit 68930602, System Technology, Inc., (STI) will suggest to AMRL/EMT motion washout schemes worth investigating. These schemes will be implemented on the roll axis tracking simulator and human operator tracking data will be collected for the different washout techniques imployed. Preliminary analysis spectrum and describing functions will be performed by AMRL/EMT and the results will be supplied to System Technology, Inc., for modeling of the effects of washout on human operator parameters. This work is being transferred from work unit 68930218.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0018, DEVELOPMENT OF MODEL FOR THORACIC DYNAMICS

I. KALEPS, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF323090)

Prediction of the mechanical response of the human thorax resulting from direct impacts or variable high-level air pressure exposures and corresponding probabilities of injury occurrence are required for the formulation of criteria for the design of manned flight systems. This effort will provide an analytic computer-based model for relating external body exposure parameters to the resulting dynamic response of the human chest wall, intrathoracic volume and flow of respiratory gases through the trachea. These model response parameters will, in turn, be used in generating injury probabilities for prescribed exposure events.

The modeling approach used will account for the motion of the chest wall, the visceral contents below the diaphragm, the intrathoracic volume and the flow of respiratory gases through the trachea. Linear, and where necessary nonlinear, elastic properties will be used for coupling of the chest wall and visceral mass to the thoracic structure. Internal coupling resulting from pressure variations within the thoracic cavity will be considered for both adiabatic and isothermal processes. Resistance to flow through the trachea will be modeled for both the laminar (slow flow) and turbulent (fast flow) cases. Injury criteria will be developed by correlating response parameters to injury incidence and severity as observed in experiments reported in literature.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0019, RPV TARGET ACQUISITION

W.N. KAMA, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321200)

This work unit will develop the necessary design criteria and concepts related to sensor/display systems for the Air Force real time and near-real time reconnaissance (NRTR) missions utilizing unmanned vehicle systems. Analytical and simulation techniques will be developed which allow the systematic variation and trade-off of pertinent NRTR design parameters, including sensor, data links, navigation and control/display characteristics. Results from this effort will provide engineering design criteria and trade-off data to assist the RPV SPO in selecting optimum subsystems for short-term operational NRTR systems as well as designing and developing advance reconnaissance/strike rpv systems. Other products include cost-effective techniques for RPV subsystems simulation including sensors, data links, and vehicle subsystems. This work unit supports AFSC development goals TC-1, C3-2, RI-1, RI-5, and MS-4.

A systems analysis of the NRTR mission, system characteristics and performance variables will be conducted. A systems simulation capability to address NRTR issues will be developed, including simulation of advanced sensor systems (i.e., forward-looking infrared, low light level TV, etc.), data link characteristics, signal processing and image enhancement algorithms. Data comparison techniques will be developed and sensor trade-off studies conducted. Experimental studies will be conducted to address specific design issues related to current NRTR and advanced RPV concepts.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0020, EFFECT OF BRAIN TISSUE OXYGEN LEVELS ON HUMAN OPERATOR PERFORMANCE

A.T. KISSEN, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF322440)

The objective of this work unit is to describe and quantitate in human analogs, by invasive or non-invasive techniques, the impact of altered breathing gas environments on cerebral func-

tion/human operator performance. Applications of findings in this work unit include (a) validation and justification for use of non-invasive techniques in place of invasive procedures for subsequent human experimentation, and (b) data input to a cerebral oxygenation-operator performance model.

Accomplishment of the objective is dependent upon execution of various technology based experiments. (1) Studies involving cerebral oxygenation of non-human primates under g stress involve relatively short time sampling periods. The use of polarigraphic oxygen probe with rapid response time characteristics must be preceded by its evaluation against the standard mass spectrometer membrane. (2) Use of non-human primates on the DES in physiologic and performance-related studies will require a DES animal platform modification to accommodate mass spectrometer analyzer and a performance display/data acquisition unit.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0021, DIRECT VISUAL MECHANISMS OF NON-DESTRUCTIVE COUNTERMEASURES

R.D. ODONNELL, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321090)

To develop and assess countermeasures against the human operator in representative threat systems which involve interference, deception, or neutralization of the visual system. To identify a large number of potential countermeasures, and to carry out a systematic, minimal-cost series of evaluations designed to eliminate low probability concepts and isolate those with a high probability of success. To refine these concepts, maximizing their effectiveness, until sufficient testing has been done to deliver the concept to operational development. This work unit supports AFSC development goals SO-5, TC-5, and TC-8.

Candidate countermeasures will be identified through study of the fundamentals of visual mechanisms, and will be subjected to a series of increasingly more high-fidelity evaluations. In the first stage, a conceptual evaluation will be done to estimate the probability of visual confusion. Secondly, laboratory evaluations will be carried out on the basic mechanism concept. Third, combined laboratory/field evaluations will be performed. Finally, where justified, high-fidelity simulator and/or field tests will be carried out. Initial concept ideas, and the confusability matrices necessary for conceptual evaluation will be derived from complementary programs in AMRL. Laboratory facilities for carrying out the second level of evaluation presently include an image metric capability, a laboratory for assessment of visual perception, a five-channel Maxwellian view optical system, and a sophisticated eye tracking system. Capability for novel psychophysical and psychophysiological evaluations are being developed. A mobile laboratory system capable of tracking real aircraft, and of simulating a broad range of countermeasures, will be placed in operational use in order to carry out the third level of evaluation. Other programs in AMRL are developing high-fidelity simulators and a metric for quantification of the threat environment. Suggested countermeasures concepts may enter the evaluation sequence at any level, depending on their previous level of investigation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0022, IN-HOUSE RESEARCH SUPPORT

W.H. SCHELKER, U.S. Air Force, Human Resources Laboratory, *Dayton, Ohio* 45433 (DF227310)

The objective of this work unit is to provide a facility with the hardware and software capability to support the in-house research program of the division on a timely basis. Research studies are to be conducted in the areas of (1) skills acquisition and transfer for remote piloted vehicles tasks, (2) visual display simulation, (3) system sensor 0imulation, and (4) computational technology applicable to flight simulation. Results of efforts under this work unit will be used in support of directly documented programs and will not result in any publishable documents such as technical reports. Future plans call for an increase in the size of the computer room and the addition of a second nine (9) track tape unit, a tape cleaning and storage facility, and possibly a second disk drive unit. A side stick controller may be added to the ROTS operator station.

Efforts will continue to improve and update the research facility used in carrying out in-house exploratory and advanced development programs of the division. A display system and additional computer storage will be procured to support programs on sensor simulation. A remote operators task station will be designed and fabricated to provide the capability to conduct research on remote operator tasks. Computer simulation models will be developed along with specialized equipments to support the division's research effort.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0023, GUIDELINES FOR ENVIRONMENTAL IMPACT STATEMENT ON NOISE

H.E. VONGIERKE, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321320)

To develop, in conjunction with the National Academy of Sciences/National Research Council Committee on Hearing, Bioacoustics and Biomechanics, guidelines for evaluating the effects of all types of environmental noise on the general population. These guidelines will be used by the EPA. When these guidelines are finished, they will be validated in order to show that they are correct and reasonable with respect to Air Force facilities as well as specifications, standards and regulations on noise exposure.

A working group of leading scientific/technical personnel is preparing these guidelines. Upon completion, these guidelines will be used to compare established predicted effects of AF noises on a community to actual measured behavioral responses. This effort relates to the concepts of NOISEMAP and of AICUZ.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0024, FLYING TRAINING RESEARCH SUPPORT SERVICES

D. WHITFORD, Univ. of Dayton, Res. Inst., *Dayton, Ohio* 45409 (DF223190; F33615-77-C-0054)

(1) To obtain quick response flying training research products through a university based contract which utilizes Air Force human resources laboratory (AFHRL), flying training research division (FT) research facilities and/or the facilities of the university itself. (2) To provide expert outside consultation to AFHRL/FT personnel concerning selected flying training problem areas.

The multidisciplinary capabilities of a university will be used to obtain flying training research on a number of high-impact research questions. The research requirements for each research project will be designed to allow full autonomy of contractor effort. On an as-required basis, university consultants will also be utilized to update or augment AFHRL/FT staff knowledge concerning critical research topics.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0025, MOTION SICKNESS IN THE CAT - AN EVALUATION OF VESTIBULAR HABITUATION RATES AND THE INCIDENCE OF SICKNESS

G.H. CRAMPTON, Wright State University, Graduate School, *Dayton, Ohio* 45431 (NCA 2-875801)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0026, VESTIBULAR SYSTEM RESPONSE TO ACOUSTIC ENERGY

D.E. PARKER, Miami University, Graduate School, *Oxford, Ohio* 45056 (DF313120; F33615-76-C-5029)

Air Force function - operational stress, environmental acoustic hazard to aircrew personnel. Deficiency - the manner in which high-intensity acoustic energy contributes to disorientation in Air Force crewmembers is very poorly understood. Research - investigate the manner in which acoustic energy stimulates the

vestibular system. How research contributes - research will indicate how high-intensity noise affects equilibrium and produces disorientation. Results will contribute toward the development of threshold criteria for hazardous exposure to high-intensity sounds.

This research will better define the dynamic response of the vestibular system to acoustic stimulation, in terms of intensity level, acoustic frequency (Hz), and intermittency rate of the stimulus. Thresholds will be determined for nystagmic and counterrolling eye movements, and postural adjustments. A study of the nature and mechanisms of the transfer of acoustic energy to the vestibular system will be made by studying stapes displacement and perilymph and endolymph pressure changes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0027, MIXED MEDIA FILTER FOR AIRCREW BREATHING SYSTEMS

G.V. COLUMBO, Umpqua Research Co., *Myrtle Creek, Oregon* 97457 (DF320320; F33615-76-C-0603)

The purpose of this work unit is to provide a comprehensive and experimental study of mixed silica gel and charcoal as a dryer/filter system for oxygen purification. These dryer/filters are to be employed on advanced military aircraft using chemically based oxygen generating systems. This effort supports ASD/AEL.

The study shall include (1) an investigation of simple mixtures of silica and charcoal, and (2) the product of the precipitation of charcoal dispersed in a solution of sodium silicate. Sorbent concentrations shall be varied such that water vapor absorption, contaminant (5 separate organic compounds) absorption, flammability, and regeneration criteria can be established in an atmosphere of 100 percent oxygen.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0028, DEVELOPMENT OF CRITERION TESTS OF PERFORMANCE IN PRIMARY AIR FORCE SPECIALTY 426X2, JET ENGINE MECHANIC

W.A. LEAF, Applied Science Assoc. Inc., *Valencia, Pennsylvania* 16059 (DF232730; F33615-76-C-0057)

To develop a series of pencil-and-paper tests for collecting improved performance criterion information in PAFS 426x2, Jet Engine Mechanic.

Traditional item construction standards will be followed to develop a series of pencil-and-paper tests which provide maximum discrimination between the following pairs of subject groups within PAFS 432x0, Jet Engine Mechanic: (1) basic airmen and 3-level workers, (2) 3-level workers and 5-level workers, and (3) 5-level workers and 7-level workers and above. After test development and administration, correlation techniques will be applied to resulting data to demonstrate whether the pencil-and-paper criterion tests do or do not discriminate among the selected subject groups. Additionally, multiple linear regression techniques will be employed to determine whether or not the contemporary selection and classification instruments need be extensively revised if validation is based on the pencil-and-paper criterion measures rather than the conventional training criteria. The project can be completed in 26 months, meeting the following milestones: a. Criterion test development (Phase I) 12 weeks. B. Criterion test administration (Phase II) 12 weeks. C. Criterion test revision (Phase III) 6 weeks. D. criterion test validation (Phase IV) 26 weeks.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0029, PSYCHO-PHYSIOLOGICAL CRITERIA FOR ASSESSMENT OF NAVAL AIR-CREW PROTECTIVE EQUIPMENT

M.M. COHEN, U.S. Navy, Crew Systems Department, *Warminster, Pennsylvania* 18974 (DN581100)

To establish appropriate physiological, behavioral, and biomedical specifications and criteria for the design, development, testing, and evaluation of protective and survival aircrew equipment. Requirements for this work have been delineated in the Naval Aviation Biomedicine/Human Effectiveness Technical Workshop Report of FY1974.

Existing data concerning the adequacy and safety of protective equipment are reviewed and complemented by in-house research studies. Physiological, behavioral, and biomedical specifications and criteria for the design and development of future life support and protective equipment are established. Medical and scientific assistance is provided to establish test protocol and safety procedures for the evaluation of prototype protective equipment. This assistance includes medical monitoring of volunteer human subjects, pre- and post-test medical examinations, medical and psychophysiological evaluations of test results, and, where applicable, suggestion for subsequent improvement of the biomedical and psychophysiological adequacy of systems.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Medical Research Institute

6.0030, CHARACTERIZATION OF HYDROCARBON EMISSIONS FROM AF TURBINE ENGINES

J.P. CONKLE, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF320850)

The efforts will provide baseline data for assessing the biomedical impact of Air Force aircraft operations, prior to the advent of regulatory restrictions. The information is required not only for assessing environmental impact but also for evaluating combustor design criteria, smoke suppression additives and engine operational cycles. The work is closely coupled and coordinated with ongoing turbine engine emissions measurement at the AFWL and AFAPL.

Chemical characterization of the organic compounds present in turbine engine exhaust will be accomplished for both gaseous and particulate specie. Samples will be obtained from a variety of sources including AF and Navy operational engine test stands and the AFAPL single combustor test rig. Analysis will be performed by a coupled gas chromatograph-mass spectrometer data system. Results will be screened by AMRL/TH for toxic hazard assessment. Prior progress in this effort has been documented under work unit 7164-16-13. This new work unit implements new technology planning objective alignment as directed by HQ Aerospace Medical Division.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0031, DEVELOPMENT OF OFFICER TEST BATTERIES AND SELECTION PROCEDURES

R.B. GOULD, U.S. Air Force, Human Resources Laboratory, *San Antonio, Texas* 78236 (DF231640)

To synthesize outcomes from the preceding work units under task 771912 and related research into officer test batteries and selection systems, to evaluate the effectiveness of such batteries and systems, and to provide a vehicle for experimentation with promising types of items or subtests.

An experimental selection test will be developed from academic, biographical, and interest content. Separate tests for the selection of student pilots and navigators will be similarly developed. Tests will be evaluated by multiple linear regression and other methods to determine their effectiveness as predictors of officer performance measures. Experimental items and subtests will be included in the tests for evaluation. Standardization populations will be investigated, and methods of using test scores in officer selection will be studied. As appropriate, effectiveness of the experimental batteries will be compared with that of the current battery.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0032, DEVELOPMENT OF DIAGNOSTIC CRITERIA FOR SIGNIFICANT HYPERTENSION IN AIRCREW MEMBERS

D. HULL, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF321840)

Uncontrolled hypertensive cardiovascular disease can lead to sudden incapacitation and its treatment has the potential of obviating performance of flying duties. This effort will define criteria for diagnosing true hypertension in contrast to labile blood pressure elevations where drug therapy is indicated, and the adequacy of blood pressure control while on waiverable medications.

Correlate the blood pressure responses during routine activities, orthostasis, and exercise in hypertensive and normotensive aircrew-members. The presence or absence of cardiac involvement will be assessed via vectocardiography and echocardiography and will be correlated with the blood pressure responses to various stresses in normotensive, hypertensive (with and without drug therapy), and labile hypertensive aircrewmembers. This work was formerly documented under work unit 7755-01-05.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0033, AIR COMBAT MANEUVERING (ACM) TRAINING
S.D. LEVERETT, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF320130)

To improve and increase the knowledge of TAC fighter pilots, physiological training officers and flight surgeons with the effects of both sustained or simulated air combat maneuvering g forces (SACM) as obtained from training on the USAFSAM human centrifuge.

By using the USAFSAM human centrifuge to simulate maneuvering g forces in high-performance aircraft, pilots, flight surgeons, or physiological training officers are able to practice their straining techniques to improve g tolerance and gain first-hand knowledge for teaching the technique to others. These individuals will be exposed to these training epochs on the USAFSAM centrifuge while they are attending academic courses at SAM.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0034, THERMAL CHARACTERIZATION OF INFLIGHT AND GROUND COCKPIT ENVIRONMENTS
S.A. NUNNELEY, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322600)

Air Force operations expose personnel to a wide variety of thermally stressful conditions both in flight and on the ground. Measurements of these conditions will be performed under work unit 7930-13-11. This data base will be used by this work unit in the development of improved environmental control system specifications, flight simulator thermal conditions and procedure and practices during thermal chamber simulation of flight. Previous accomplishments in this area are documented under work unit 7164-17-23. This work unit is being established to implement a new technology planning objective as directed by HQ Aerospace Medical Division.

The data base established by work unit 7930-13-11 will permit calculation of human stress indices and provide a basis for rewriting MIL-E-38453A, as requested by the ASD Power and Propulsion Directorate. The new specification will allow trade-off studies by engineers in designing new systems. In addition, specifications will be developed for the performance of liquid conditioning garments, flight simulators and thermal chamber experiments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0035, EEG REPOSITORY
J.J. ROBIN, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322060)

The objective is to develop long-period EEG recordings and automated analysis capability in order to refine the definition of normal/abnormal status and apply these data to flying personnel on a short- and long-term basis. New methods and material will be developed to enable accurate identification of flyers with various neurological conditions which pose a hazard to flying safety or efficiency.

The approach is to obtain routinely an EEG on all subjects undergoing full evaluation by the Aeromedical Consultation Service and microfiche each recording for permanent storage. Individuals receive stimulation/provocation with hyperventilation and photic stimulation and if any abnormalities are noted, a sleep-deprived EEG is obtained. Interpretations are made in accordance with the Mayo Clinic system. Records that are interpreted as abnormal are retained, normal recordings are microfiched and destroyed. EEG abnormalities noted in the aircrew population and a matter of record in the EEG repository will be evaluated for true risk of occurrence of definite neuorological sequelae over time. This effort was previously documented under work unit 7755-04-08.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0036, LIMITS FOR BREATHING GAS MIXTURES FOR COMBAT MANEUVERING ENVIRONMENTS
J.E. WHINNERY, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322270)

Determine the range of oxygen concentrations in aircrew breathing mixtures that will prevent or retard the development of atelectasis during or after exposure to acceleration stress. Aircrew members breathing 100 percent oxygen during exposure to acceleration stress in high-performance aircraft have shown an increased incidence of symptoms of the aeroatelectasis syndrome which include retrosternal chest pain, difficulty in breathing, and a desire to cough. These have been attributed to alveolar collapse in the dependent regions of the lung, which is felt to be caused by the compression of the dependent lung fields by the combined effects of the acceleration stress and anti-g suit inflation and the rapid absorption of oxygen from these compressed alveoli. The presence of nitrogen in the inspired gas mixture has been shown to retard the rapid absorption of oxygen from alveoli and thus prevent or retard the development of the syndrome. The combined effects of acceleration stress and breathing intermediate concentrations of oxygen have not previously been studied. Data obtained will serve as a basis for establishing criteria of maximum acceptable concentration of inspired oxygen to be utilized in high-performance aircraft aircrew breathing systems. This maximum acceptable concentration should be of sufficient magnitude to provide the advantages of an increased concentration of inspired oxygen required in the fighter aircraft environment.

Human volunteer subjects will be exposed to various levels of acceleration stress while inspiring gas mixtures containing various concentrations of oxygen and nitrogen. The responses of the respiratory system will be examined and analyzed to determine the degree of physiologic change imposed by these combined stresses. Data will include, but not be limited to, effects on pulmonary compliance, pulmonary resistance, tidal volume, frequency of breathing, and pulmonary ventilation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0037, EVALUATION OF HARMONIC ACCELERATION AS A DIAGNOSTIC TEST OF VESTIBULAR FUNCTION
J.W. WOLFE, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF321650)

This effort is concerned with the delineation of parameters of harmonic (sinusoidal) angular acceleration which will aid in the diagnosis of peripheral and/or central vestibulo-oculomotor pathology in aircrew members.

Using modern analog and digital techniques, nystagmic (eye movement) data will be collected from both animal and human subjects during harmonic stimulation. These data will be analyzed for phase shift and slow phase symmetry. This study is a continuation of work formerly documented under work unit 7755-08-14.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0038, AUTOMATED MOTOR SKILLS TRAINING OPTIMIZED FOR INDIVIDUAL DIFFERENCES
R.C. WILLIGES, Virginia Poly. Inst. & St. U., Graduate School, *Blacksburg, Virginia* 24061 (DF046460; AF-AFOSR-3161-77)

AF function - many Air Force synthetic flight trainers are computer-controlled devices which can be programmed for individual training to enhance their training effectiveness. However, it is necessary to optimize training by allowing for individual differences. Deficiency - because each student is unique in terms of experience, learning rates, approach to the training environment, and control styles, a single pre-determined training program is not always optimum for each individual. Objective - the objective of this research program is to investigate procedures for providing computer-adaptive motor skills training which is optimized for student individual differences. How research contributes - research to determine how training strategy interacts with previous experience, as well as with demographic variables, will assist in determining the proper training model to use with a particular student.

A two-pronged research program plan is proposed to investigate several of the fundamental research issues underlying the use of automated procedures in motor skills training. These issues deal with individual differences in motor skills acquisition and the investigation of parameters of adaptive training systems. Experimental investigation of these two issues is needed before direct applications and optimizations of automated motor skills training procedures can be made to Air Force operational synthetic flying training devices.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, STRUCTURAL OPTIMIZATION BY FINITE ELEMENTS

G. SANDER, Univ. of Liege, *Liege*, *Belgium* (DF046090; AF-AFOSR-3118-77)

AF function - advanced and aerospace vehicles will require new design and optimization methods for future mission performance. Opportunity - new analysis techniques are becoming available which can significantly enhance vehicle structural designs to achieve more efficient behavior. Objective - the objective of this research is to investigate computerized algorithms which can yield optimal structural designs considering multiple constraints. How work contributes - this research contributes to Air Force programs investigating new vehicle design and analysis procedures.

Research will investigate the approaches to structural optimization. Relationships between math programming and optimality criteria will be examined through development of suitable algorithms. Structures to be considered will be idealized by finite-element techniques. These studies will examine solution convergence and techniques to improve convergence. In addition, multiple constraints which arise when considering flexibility, vibration and stability will be considered in algorithm formulations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0002, AIRFOILS AT SONIC VELOCITY 14309-E

J.D. COLE, Univ. of California, School of Letters & Science, *Los Angeles*, *California* 90024 (DA0E9259; DAAG29 77 G0022)

To construct in a systematic manner some lifting airfoil flows with sonic freestreams for realistic shapes. Relevance - the research is highly relevant to the necessity of establishing accurate far-field boundary conditions and bench-mark test cases for finite-difference solutions for transonic flow being developed at AMRDL.

The small disturbance equations for two-dimensional sonic flows past airfoils is transformed into the hodograph plane where solutions are constructed for lifting airfoils by properly superposing singular solutions representing the correct free-stream singularity and behavior at the nose region.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

7.0003, GENERAL SIMILARITY SOLUTION OF THE TRICOMI EQUATION AND ITS APPLICATIONS

J.D. COLE, Univ. of California, School of Letters & Science, *Los Angeles*, *California* 90024 (DF046600; AF-AFOSR-3173-77)

AF function - aerospace vehicle design. Opportunity - possibly more economical transonic wing design. Objective - improved analytic techniques for compressible flow problems. How work contributes -numerical parameter optimization is often aided by analytic understanding.

The general similarity solution for a partial differential equation can be found by studying the infinitesimals of the group of transformations which leave the equation invariant. The TRICOMI equation is the simplest partial differential equation of mixed type. The four-parameter group which leaves the TRICOMI equation invariant has been found. It is proposed to study the resulting similarity forms, the geometry of the similarity curves, and to construct the general solution of the ordinary differential equations which result. These solutions can be interpreted as the hodograph streamlines of a transonic flow. Thus new classes of practical flows will be generated by interpretation of particular similarity solutions and their superposition if necessary.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0004, GRAPH ALGORITHMS - KEY TO IMPROVED COMPUTING METHODS IN ENGINEERING PROBLEMS

R.E. TARJAN, Stanford University, School of Hum. & Sciences, *Palo Alto*, *California* 94305 (DN675391; N00014-76-C-0688)

After the calculus, the single most important concept in modelling engineering design and particularly operations analysis problems is the concept of a graph (a collection of 'nodes' connected by 'edges'). Graphs are used, and graph theoretic algorithms must be devised in electronic circuit design, the design of both communications and logistics networks, the analysis of a great variety of computational algorithms (e.g., for information retrieval), and the flow analysis of the computer programs which implement these algorithms. Graph theoretic notions have recently become very important in the study of techniques for the solution of sparse matrix problems. Sparse matrix techniques are often the key to the solution of important Navy fluid dynamics problems, both problems of geophysical fluid mechanics (weather and oceanographic modelling) and fluid problems arising in ship and aircraft design. This proejct will develop improved computer procedures for the solution of the graph problems generated in the above applications.

This effort will develop general methods which can be applied to the efficient solution of a variety of specific graph problems. The project will also apply these general methods to specific problems. In addition, analyses of the relative computational efficiency of various algorithms will be carried out.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

7.0005, MATHEMATICAL TECHNIQUES FOR NON-LINEAR SYSTEM THEORY

R.E. KALMAN, State University of Fla. Sys., School of Engineering, *Gainesville*, *Florida* 32611 (DF044000; AF-AFOSR-3034-76)

AF function - the initial design of Air Force control systems. Deficiency - methods used in the engineering design of these systems are based upon obsolete conventional mathematical analysis which does not take proper account of the digital nature of modern systems. Objective - it is the objective of this research program to develop special tools of applied algebra to formulate and solve problems related to new system configurations. How work contributes - this work could lead to the creation of entirely new types of systems, e.g., systems in which data processing is conducted using only integers, eliminating round-off errors.

Research will be conducted in three main areas of work. First, there will be an ongoing investigation of Hankel-matrix techniques and the initial study of the nonlinear reduction problem. Second, there will be the invariant study of quadratic optimization with linear dynamics. Finally, the new nonlinear system theoretic method will be extended to control and state-estimation problems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0006, CLIMATIC DATA COMPACTION AND RETRIEVAL
P.N. SOMERVILLE, State University of Fla. Sys., School of Arts & Sciences, *Orlando, Florida* 32816 (DF248890; F19628-77-C-0080)

AF function - support weather-sensitive Air Force and Army mission. Deficiency - current military mission planning requires a more expeditious recall of basic climatic probabilities than is presently available. Development - apply statistical theory and computer methods to the climatic records. How development contributes - will contribute to a military capability to expeditiously assess the climatic influence on a mission and avoid underestimations of risk of operation anywhere worldwide.

The approach is statistical, to adapt analytical models and algorithmic computer methods, so that they can be used to compress historical records of weather events. Retrieval of information is made in probability terms. Weather elements to be investigated will include ceiling, visibility, winds and precipitation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

7.0007, IMPROVEMENTS TO CDC OFF-LINE MAINTENANCE SOFTWARE AND CDC TEST CART SOFTWARE
G.W. HOWE, Raytheon Company, *Wayland, Massachusetts* 01778 (FA77NA-4008; FA160003 (TRAIS NO.))

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

7.0008, METHODS FOR COMPUTING THE PATTERN OF COMPRESSIBLE FLUID FLOW IN NOZZLES OR PAST BODIES
H. KREISS, New York University, School of Arts & Sciences, *New York, New York* 10012 (DF039000; F44620-74-C-0062)

AF function - the study of nuclear weapons effects on aerospace vehicles and ground structures, the design of aerospace vehicles. Deficiency - current numerical schemes for transonic nozzle flow are not efficient. Also, the computation of shocks suffer from factors like smearing and post shock oscillations. Objective - the numerical solution of the partial differential equations arising in many fluid flow problems require the replacement of an infinite domain for a finite one. Various principles for specifying the appropriate boundaries conditions in the downstream boundary so that no reflection of high frequencies take place have been proposed. Schemes based on these principles are not very reliable. This research will investigate new principles by using appropriate asymptotic extensions and to use them to derive new difference approximation at the downstream boundary. In addition, investigations involving improvements in the performance of the artificial compression method will continue. How this work contributes -this research will lead to more effective and efficient computational schemes for transonic flows and shock calculations.

Numerical techniques for computing transonic nozzle flows will be studied. A finite-difference scheme for steady-state transonic flow will be investigated and the following questions will be studied - is the solution smooth at the intersection of sonic surface with the boundary? Is the shape of the sonic surface uniquely determined by the properties of the nozzle? Moreover, this research is continuing the perfection and generalization of the ACM method to solve application problems of interest to the Air Force.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0009, PROGRAMMING SERVICES IN SUPPORT OF THE CONTROLLER/COMPUTER INTERFACE LABORATORY MISSION
UNKNOWN, U.S. Small Business Admin., *New York, New York* 10007 (FA77NA-4004; FA59983 (TRAIS NO.))

The purpose is to provide technical assistance and support to the Human Engineering Branch at NAFEC in development of software for the Controller/Computer Interface Laboratory (CCIL). The CCIL is a NAFEC Facility used by Human Engineering personnel engaged in making evaluations of candidate air traffic control data entry and display configurations.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

7.0010, NEW CAPABILITIES OF WALSH FUNCTIONS AND WALSH TRANSFORMS
D.K. CHENG, Syracuse University, School of Engineering, *Syracuse, New York* 13210 (DF040740; AF-AFOSR-2809-75)

AF function - processing of signature data. Opportunity - the Walsh functions have capabilities usable in the efficient processing of signature data in computers. Objective - this research intends to establish on firm basis the foundations of Walsh functions as a tool for solving nonlinear differential equations and filtering problems. Efforts will include the development of computational algorithms involving walsh functions. How work contributes - results may lead into computational tools for the reduction of signature data.

This research will include two main thrusts. First, the following topics will be covered - comparison and critical evaluation of two approaches in solving nonlinear differential equation, analysis of practical nonlinear systems with typical excitations, and computer simulation of filter design for optimum noise reduction. The second group of topics include - development of a fast algorithm for computing dyadic convolutions, extension of the basic algebra of discrete Walsh functions to that for nonintegral sequences, applications to problems of system identification and synthesis, analysis of channel noise in pulse-code-modulation systems, and development of a generalized transformation matrix for proper processing of scanned 2d images.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0011, DEVELOPMENT AND DELIVERY OF A TERMINAL AREA FORECAST FILE ON MAGNETIC TAPE
UNKNOWN, Infodata Systems Incorporated, *Falls Church, Virginia* 22091 (FA77WA-4085; FA160429 (TRAIS NO.))

The Contractor shall develop and install on a time-sharing facility as specified by the FAA, four COBOL program to extract specified data elements from the National Flight Data Center file (NFDC), Airport Activity Statistics file (AAS) and the Air Traffic Activity file (ATA) and from this extracted information produce the base-year Terminal Area Forecast file. In addition, the Contractor shall create INQUIRE data bases for all files referenced above.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, LOW-TEMPERATURE RESEARCH IN LIQUID HELIUM
R.E. PACKARD, Univ. of California, School of Letters & Science, *Berkeley, California* 94720 (DMR76-82934 A01)

Research done under this grant will be a continuation of research begun under NSF Grant No. DMR73-02461. The work involves two main projects: vortex photography and ultralow-temperature research on 3He. A technique has been developed to photographically record the positions of quantized vortex lines in superfluid helium. Both the dynamics of vortex motion and the

equilibrium distribution will be studied. The 3He work is done in a nuclear demagnetization refrigerator. Experiments to study the flow properties and magnetic relaxation properties of the low-temperature phases of 3He will be performed.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0002, ELECTROCHROMIC GLASSES 14249-P
R. BRAUNSTEIN, Univ. of California, School of Letters & Science, *Los Angeles*, *California* 90024 (DA0E9228; DAAG29 76 G0321)

To develop an understanding of the mechanism of electrochromism exhibited by tungstate, molybdate and other glass systems. Relevance -beyond the relevance to solid-state display and optical memories, there is the intriguing possibility of producing an 'electret glass' which might be viewed as a laser material having both a high cross-section for emission and broad line width.

To study electro-coloration phenomena in various transition-metal oxide glass systems using electrolyte techniques, electronic band properties of the intrinsic and colored glasses by means of optical spectroscopy (reflectivity, transmission, and modulation techniques), and transport properties will be studied by electrical conductivity and photoconductivity techniques. New techniques of photo-mixing will be used to study the drift mobilities in these materials. Infrared absorption and reflection as well as Raman scattering will be employed to study short- and long-range order in these systems--these studies will also serve as analytical tools to study the feasibility of fashioning 'electret glasses'.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0003, GENERATION OF HIGH-BETA PLASMAS AND DIAGNOSTICS
A.Y. WONG, Univ. of California, School of Letters & Science, *Los Angeles*, *California* 90024 (DF044880; F49620-76-C-0011)

AF function - operation of high-altitude vehicles in a post-nuclear explosion environment, development of electromagnetic weapons, both laser and beam weapons, space and ionospheric communications and countermeasures demand design data which can only be obtained from fundamental understanding of high-temperature high-beta plasmas. Deficiency - present-day understanding of high-temperature high-beta plasmas, e.g., waves and instabilities as well as localized phenomena, cavitons and solitons is incapable of satisfying the aforementioned requirements. Objective - this research will develop suitable instrumentation such as microwave holography and microwave tomography to perform experiments on steady and unsteady plasmas at various conditions of density and temperature. Contribution - this work is a part of a comprehensive program of plasma research for the development of an X-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and ion beam), the development of space and ionospheric communications, and the development of countermeasures.

Microwave tomography will be used to map the three-dimensional density distribution. Using electronic switched transmitting and receiving arrays it may be possible to sample the radiation patterns periodically and thus determine the time evolution of density. By using an on-line computer the density profiles may be reconstructed within a few seconds. For the reconstruction of the three-dimensional plasma distributions two basic techniques will be used - (a) inverse propagation and (b) microwave tomography. After development these diagnostic techniques will be used in the UCLA high-density SURMACS. In addition theoretical investigations will be performed to explore models relating to the aforementioned microwave transmission properties of the plasma. A second area of investigation is the extension of the plasma parameters into regimes of higher temperatures which can be accomplished by adiabatic magnetic compression. The device to be developed will be suitable for numerous wave experiments such as whistlers, ion-cyclotron, and other MHD waves.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0004, THEORY OF TRIATOMIC COLLISIONS INVOLVING TWO ELECTRONIC STATES
F.T. SMITH, S R I International, *Menlo Park*, *California* 94025 (DF041190; F44620-75-C-0073)

AF function - this research contributes to RO 6.1, nuclear weapons effects. Deficiency - information on state-to-state reaction cross sections is needed for prediction of distribution of energy in fireballs. Objective - this research is directed toward development of theoretical techniques for dealing with nonadiabatic collision and reaction processes. Contribution - this research will lead to improved ability to obtain the needed state-to-state reaction cross sections.

Investigations are being made of coordinate systems appropriate for three-body interactions that treat the three particles symmetrically and various types of coupling that link different electronic states.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0005, ORGANIC AND ORGANO-METALLIC CONDUCTORS AND SUPERCONDUCTORS
W.A. LITTLE, Stanford University, School of Hum. & Sciences, *Palo Alto*, *California* 94305 (DMR76-82087 A02)

The overall goal of this project is to advance our knowledge of the solid-state physics and chemistry of compounds containing strongly interacting substructures so their physical properties can be understood, designed and predicted. Part of this work is concerned with the broad question of the attainability of high-temperature superconductivity through systematic study of linear chain compounds. This includes the synthesis of polarizable ligand systems, plus model studies of stacked arrays of square planar complexes and the effects of oxidation upon them. Physical properties are measured and studies made of theoretical problems bearing on high Tc (critical temperature) materials.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0006, WORK ON LASER-ELECTRON BEAM INTERACTIONS
R.H. PANTELL, Stanford University, School of Engineering, *Palo Alto*, *California* 94305 (NSG 2292)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0007, MATERIAL SUPPORT TECHNOLOGY - CONTROL OF IMPURITIES IN THE EPITAXIAL GROWTH OF HIGH-QUALITY GAAS
D.A. STEVENSON, Stanford University, Center for Materials Research, *Palo Alto*, *California* 94305 (DN475330; N00014-75-C-0887)

The Navy has use for gallium arsenide electronic devices in microwave communications and surveillance systems. This program will investigate the control of residual impurities and electrically active centers in the synthesis of high-purity epitaxial gallium arsenide.

The investigators will analyze the thermal-chemical reactions in a controlled growth system to determine the source of impurities, correlate the residual impurity with gas species, and modify the reactions accordingly. Two principal activities are to be undertaken: the development of liquid-phase epitaxial growth techniques to control impurities; and the design and construction of a molecular beam-mass analyzer system to sample, at growth temperatures and atmospheric pressure, the gaseous environment involved in the chemical transport reactions during crystal growth.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0008, EPITAXIAL GROWTH OF GE-GAAS
A.A. IMMORLICA, Rockwell International Corp., *Thousand Oaks*, *California* 91320 (DF044620; F44620-76-C-0134)

AF function - microwave solid-state electronic devices are essential components of Air Force surveillance, electronic countermeasures, and communications systems. Opportunity - GaAs Impatt diodes are limited in their efficiency due to the fact that the same material is used in both the avalanche and drift regions of the device. An improvement in efficiency is possible by using a narrow bandgap material for the avalanche zone and a high-drift velocity material in the drift region. Objective - the objective of this research is to solve the materials growth problems of Ge-GaAs heterojunctions by employing state-of-the-art liquid-phase epitaxy techniques. How work contributes - a properly grown heterojunction of this type with Ge (narrow bandgap) and GaAs (high velocity) promises to produce Impatt devices with efficiencies up to 25 percent greater than those of GaAs READ-type Impatts.

The main problem with liquid-phase epitaxy growth of a Ge-GaAs heterojunction is autodoping due to substrate dissolution. It has been found that the most critical factors influencing crystal formation vs. autodoping by meltback of the substrate are the melt saturation conditions at the liquid-crystal interface and the thermal stability at this interface. The work proposed here will use a unique liquid-phase epitaxial system to grow Ge layers on GaAs substrates. This growth system is transparent so that one can observe the condition of the melt and experimentally determine the liquid's phase boundary as well as the degree of supersaturation of the melt. This system also includes a Ge source crystal in one pocket of the graphite platform. The Ge melt can then be precisely saturated by equilibrating the melt over the source crystal before commencing growth. A final feature of the system is the incorporation of a cold finger in intimate contact with the growth crucible. This cold finger can extract heat from the system and thus introduce a strong temperature gradient across the growth interface. This gradient increases the thermal stability at the interface and thus reduces the possibility of autodoping. Layers will be characterized by optical scanning electron microscopy and current-voltage and Hall effect measurements. Elimination of autodoping in the Ge-GaAs system due to the solubility of GaAs in the Pb solvent will be attempted. (Text abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0009, NAVAL MATERIAL SUPPORT TECHNOLOGY - RESEARCH ON THE GROWTH AND PREPARATION OF CRYSTALS FOR NAVY DEVICE APPLICATIONS

H. LESSOFF, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN620096)

Determine crystal growth mechanisms and perfect techniques for growth of crystals of inorganic materials needed by the Navy for acoustic, electronic and other device purposes.

Single crystals of such materials as potassium chloride, lithium niobate and gallium arsenide are grown from melts by crystal-pulling and directional-freezing (Bridgman) methods. Solution-growth methods are used for purification of halides and nitrates, and for epitaxial growth. Additional growth techniques are being sought for growth of crystals including anion-substituted magnetic oxides, gallium arsenide, indium phosphide, strontium fluoride, and metal alloys, as well as for prediction of desirable electronic and optical properties in substances being considered for crystal-growth studies.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0010, THEORY OF ATOMIC STRUCTURE

B.R. JUDD, Johns Hopkins University, School of Arts & Sciences, *Baltimore, Maryland* 21218 (PHY77-22488)

Research in theoretical Atomic Physics initiated under NSF grant PHY73-05195 A03 will be continued. Analyses will concentrate on atoms and ions in various environments and external fields, particularly those produced by lasers. The principal topics of study are (a) The Jahn-Teller effect for trapped electrons or for ions at sites of various symmetries in crystals; (b) Correlation crystal fields for Lanthanide ions; (c) Quantum optics, with emphasis on multiphoton ionization; (d) Autoionizing states in highly ionized atoms; (e) Lifetimes of Rydberg states; and (f) Photoionization cross sections. The aim of the work is to improve our understanding of the fundamental processes inherent in atomic systems and to develop the relevant mathematical techniques.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0011, THEORETICAL PROBLEMS IN CONDENSED MATTER AND STATISTICAL PHYSICS

H. EHRENREICH, Harvard University, School of Arts & Sciences, *Cambridge, Massachusetts* 02138 (DMR77-10210)

Continuation of research supported under DMR75-02649.

Theoretical research on a wide variety of problems in condensed matter science will be carried out. These include: (1) The statistical mechanics of systems near a critical point with applications to multicritical points, effects of impurities on magnetic systems and liquid crystal phase transitions. (2) Dynamical critical phenomena, utilizing the theory of the renormalization group on liquid helium, He3-He4 mixtures, structural phase transitions and spin-waves. (3) Solvable models of one-dimensional Fermi systems, such as an electron gas and coupled electron chains. (4) The study of the onset of turbulence in fluids. (5) Electronic properties of transition metals, alloys and compounds, e.g., transition metal hydrides. (6) Investigations of disordered systems, such as liquid and amorphous metals and spin glasses. (7) Layered superconductors and non-equilibrium superconductivity.

Other miscellaneous topics will be investigated such as spinodal decomposition, the dynamic structure of fluids, superradiance, photoemission, 1/f noise and the origin of the earth's magnetic field.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0012, ELECTROMAGNETIC SOUND GENERATION FOR NON-DESTRUCTIVE TESTING

R.L. THOMAS, Wayne State University, School of Liberal Arts, *Detroit, Michigan* 48202 (DF038370; AF-AFOSR-3347-77)

AF function - aircraft and missile nose cones (electromagnetic windows) must frequently operate in a rain or hail environment at very high velocities. The ceramic windows must be nondestructively evaluated (NDE) for damage prior to release for future operations. Opportunity -NDE techniques are being developed to find the damaged areas before catastrophic failure occurs. Objective - this research seeks to understand the generation, transmission and scattering of bulk and surface ultrasonic vibrations in metals and ceramics for NDE applications. How work contributes - quality assurance and field maintenance inspection of critical metal and ceramic components will be facilitated.

Experimental studies will be made of the application of modified electromagnetic sound generation techniques (EMAT) to NDE problems in ceramics. Interdigital surface wave transducers will be fabricated and used together with evaporated CDs and/or ZnO thin films to generate and detect the sound waves. Studies of surface flaws on specimens of glass and glass-ceramic materials will also be extended and applied to these materials, using thick RF sputtered metal films and bonded metal foils with meander line transducers. Further studies of phase comparison techniques for NDE in metals will be made using meander line transducers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0013, OPTICAL HYPERFINE STRUCTURE AND ISOTOPIC SHIFT STUDIES

G.W. GREENLEES, Univ. of Minnesota, School of Liberal Arts, *Minneapolis, Minnesota* 55455 (PHY77-21737)

This grant will support research on fine details of atomic spectra using very high precision laser techniques. These measurements yield information on the electric and magnetic properties of the nuclei of the atoms studied.

These techniques are also highly sensitive allowing measurement on a single atom crossing the laser beam.

The method will be used to study highly unstable nuclei which are produced only in small quantities and decay quickly.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0014, HIGH-FIELD NUCLEAR ACOUSTIC RESONANCE STUDIES OF SINGLE-CRYSTAL METALS, INSULATORS, AND SEMICONDUCTORS

R.K. SUNDFORS, Washington University, School of Arts & Sciences, *St. Louis, Missouri* 63130 (DMR76-80158 A01)

A series of experiments on single-crystal transition metals with known concentrations of hydrogen, on other pure non-cubic metal single crystals, on pure germanium, and on the alkali bromides will be continued. Nuclear acoustic resonance (NAR) using both dynamic quadrupole coupling and dynamic Alpher-Rubin coupling will be employed where possible as the experimental technique. High magnetic fields up to 85 kilogauss in the temperature range from 4.2 K to 300 K will be used with on-line computer signal averaging and data analysis. The NAR dynamic quadrupole coupling and Alpher-Rubin coupling lineshapes, linewidths, and line positions of Ta181 will be studied in single-crystal tantalum as a function of hydrogen concentration and temperature in both the alpha and alpha plus beta phases. The H1 linewidths and line positions will also be studied if the resonance proves observable in tantalum. Extensions of these studies are planned for V, Nb, and Pd. NAR lineshape, linewidth, and line-position studies will be carried out at the highest magnetic fields in single-crystal Be and Mg. NAR studies using dynamic quadrupole coupling of Ge73 in pure germanium single crystal to determine lineshapes, linewidths, and the components of the tensor S relating electric field gradients to elastic strain will be carried out. Finally, NAR dynamic quadrupole coupling studies of the alkali bromides to determine the components of the tensor S observable at anion and cation nuclear positions will be done.

This is ths first year of a two-year continuing grant. Research initiated under NSF Grant No. DMR73-07629.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0015, HIGH-RESOLUTION ATMOSPHERIC TRANSMITTANCE STUDY 13746-GS

R.L. ARMSTRONG, New Mexico State University, School of Arts & Sciences, *Las Cruces, New Mexico* 88001 (DA0F8997; DAAG29 77 G0127)

To conduct a high-resolution spectral study of the Nu sub 2 fundamental of Co sub 2 at 15 um emphasizing the q-branch profiles. Relevance - broadband transmission is important in the design and operation of laser-aided night vision devices, meteorological satellite-borne infrared radiometers used to obtain atmospheric temperature profiles, and instrumentation for pollution monitoring.

An infrared tunable semiconductor diode laser source will be used to obtain experimental spectral profiles of the gas in a multi-pass white cell. Spectra taken under different conditions of temperature and pressure will be used to assess the importance of the different broadening and correlation effects. Complimentary theoretical research will involve computer generation of theoretical line shape profiles as a function of both temperature and pressure.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0016, COMMUNICATIONS - ELECTRICAL PROPERTIES OF ION-IMPLANTED GALLIUM ARSENIDE

M.A. LITTLEJOHN, Univ. of North Carolina, School of Engineering, *Raleigh, North Carolina* 27607 (DN475218; N00014-75-C-0827)

Advanced Navy electronic systems will use components fabricated from materials using new techniques. Gallium arsenide is a semiconductor which offers increased capability in electron devices and the technology and physics must be understood and developed for fabricating devices in this material using ion implantation.

Following the implantation of various impurity ions into GaAs substrates, different surface encapsulants are applied and thermal annealing of lattice damage is carried out. At each stage, transmission electron microscopy (TEM) or diffraction (TED) measurements are made. Identification is made of vacancy segregations, or interstitial segregations, or impurity precipitates or chemical precipitates, as a function of distance from the surface. The resultant defect profiles are correlated with electrical properties of the implanted samples. Silicon dioxide and silicon nitride are used as encapsulants. They are the most commonly used materials and produce different results in almost all cases. Experiments using co-implantation of gallium or arsenic atoms will be carried out to try to understand the effects on the redistribution of impurities seen in previous experiments. Substrate temperature will also be varied.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0017, COMMUNICATIONS - MAGNETIC MEMORY MATERIALS AND LIQUID CRYSTALS

H. CALLEN, Univ. of Pennsylvania, School of Arts & Sciences, *Philadelphia, Pennsylvania* 19104 (DN475096; N00014-76-C-0106)

This work is concerned with the development of improved magnetic materials useful to the Navy as memory components in computers, for logic applications and for display devices in its communications and surveillance operations.

It is proposed to analyze the preferential-site-ordering mechanism which determines uniaxial anisotropy in garnets. This will provide a new method of determining the dynamics and mechanism of crystal growth in such materials. Such information is needed for improving magnetic materials useful in magnetic bubble technology. Domain hardness, wall mobility and velocity saturation are among the areas to be investigated. In addition a study will be made of modern critical phenomena theory and phase transitions in liquid crystals.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0018, SURVEILLANCE AND COMMUNICATION - CONTROLLABLE SUPERCONDUCTING WEAK LINKS

D.N. LANGENBERG, Univ. of Pennsylvania, School of Arts & Sciences, *Philadelphia, Pennsylvania* 19104 (DN575361; N00014-75-C-0925)

The objective is to investigate those properties of controllable superconducting weak links which are useful for surveillance and communication systems of interest to the Navy.

Controllable Josephson weak links induced by externally injected quasiparticles are being investigated. The effects of injection region geometry, weak link material and substrate material are being studied. Pulsed injection will be explored to determine the limitations of response speed of the weak link.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0019, PHYSICAL ADSORPTION QUANTUM STATES ON SOLID SURFACES

D.R. FRANKL, Penn. State University, School of Science, *University Park, Pennsylvania* 16802 (DMR77-22961)

Research on atomic beam diffraction from solid surfaces and the dynamics of the elastic scattering process previously supported by DMR-7516603 A01 will be extended as follows: (a) The precise energy-level determinations which have been completed for helium three and helium four on NaF and are in progress on LiF will be extended to several more alkali halides and then to other ionic crystals, especially oxides. Theoretical studies of the interaction potentials will be carried on concurrently by a colleague. (b) Semiconductors, which were previously found to give largely diffuse scattering, will be reexamined at the longer wavelengths made obtainable by a recently completed liquid-helium-cooled nozzle holder. One objective is to elucidate the structure of reconstructed surfaces. (c) Several puzzling effects of surface temperature and history will be investigated using an ap-

paratus with in-site cleavage that is uniquely suited to this work. (d) A time-of-flight energy analyser will be added to the apparatus so as to obtain quantitative dispersion data for surface phonons.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0020, MATERIAL SUPPORT TECHNOLOGY - INVESTIGATION OF OPTICAL BIASING ON THE QUANTUM TRANSPORT PROPERTIES OF SEMICONDUCTORS

D.G. SEILER, North Texas State University, School of Arts & Sciences, *Denton, Texas* 76203 (DN675241; N00014-76-C-0319)

To investigate transient and non-equilibrium effects in quantum transport properties of electrons and holes in semiconductors that find application in naval electronic systems.

The investigator will study the quantum transport of electrons and holes generated by optical irradiation in the presence of high electric and magnetic fields. During this study, new tools will be developed and utilized to provide information on determination of the non-equilibrium electron temperature and the effect of laser irradiation upon this temperature, to determine the transient effects of the Shubnikov-de Haas and magnetophonon resonance effects in pulsed electric fields and the corresponding energy relaxation times, and to study the properties of the nonequilibrium carriers through spin-splitting of the Shubnikov-de Haas effect. In addition, an international conference on hot electrons will be held 6-8 July, 1977, in Denton, Texas.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0021, PHOTO-ACOUSTIC AND PHOTO-THERMAL EFFECTS IN IMPURITY ION SYSTEMS 13462-P

W.M. YEN, Univ. of Wisconsin, School of Letters & Science, *Madison, Wisconsin* 53706 (DA0W5570; DAAG29 76 G0100)

To evaluate the photo-acoustic and photo-thermal effects of optically active ions in solids, and to extend presently utilized techniques toward increased sensitivity and narrow band resolution. The research information is relevant to a fundamental understanding of non-radiative processes that occur in solid-state lasers. These processes are a principal contributor to the low efficiency of laser devices used in range finding and illuminator/designation applications. An understanding of such processes can lead to important design improvements with respect to size, weight, and wavelength operation of military lasers.

Non-radiative photo-acoustic signals of impurity ions in crystals will be used to study lattice phonon annihilation in hot phonon sideband transitions accompanying sharp lines, and to study energy transfer when ion-ion interactions become important. Double acoustic modulation techniques will be investigated as a means of analyzing cascade processes of radiative and non-radiative steps. Photo-thermal spectroscopy will be investigated as a supplementary technique to the measurement of non-radiative processes.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0022, PION-NUCLEON INTERACTION AT LAMPF

G.A. REBKA, Univ. of Wyoming, School of Arts & Sciences, *Laramie, Wyoming* 82071 (EY-76-S-02-2197)

A series of experiments has been initiated to study several charge states of the reaction pi N yields pi pi N near their thresholds and to compare the average moduli of the matrix elements extrapolated to the thresholds with the predictions of soft pion theory. These experiments will test the applicability of the theory to the reactions, and will also provide more information about the processes just above the thresholds than has previously been available. The theory contains two parameters, the pion decay constants f pi which is determined consistently to 15 percent by other processes and the measure of deviation from the sigma model xi; hence at least two charge states must be studied to confirm or deny the theory. The first experiment measured d2 sigma/d lambda dT for the positive pion mesons in the center of momentum for negative pion p yields negative pion positive pion n at six energies between 229 and 356 MeV with a doubly focusing magnetic spectrometer, and these doubly differential cross sections have been integrated to find the reaction cross section. From these measurements, xi has been determined to about 10 percent for a given pion decay constant. An additional experiment now in progress will measure the cross sections for this reaction at 200 and 229 MeV to reduce the uncertainty in the process of extrapolation and hence to establish xi to about 5 percent or better. Techniques for observing other charge states will be studied and a suitable experiment proposed which will critically test the applicability of soft pion theory. If the applicability is tentatively accepted, the experiment completed would yield the most accurate measurements available for the S wave, isoscalar and isotensor pi pi scattering lengths.

In another series of experiments with the same apparatus, the cross sections for positive pion and negative pion double charge exchange in the disintegration of 16O, 40Ca and 208Pb will be measured. Comparison with theory should indicate the importance of double scattering, 3.3 resonance exchange, and nucleon-nucleon correlation in this process. (Text abridged.)

SUPPORTED BY U.S. Dept. of Energy, Div. of High Energy & Nuclear Physics

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, OPTIMIZATION OF A TRANSPORTATION SYSTEM PLANNING PROBLEM

W.E. WILHELM, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (DF047450; AF-AFOSR-3230-77)

Af function - the logair network analysis project and other transportation system problems of interest to the logistics command. deficiency - for the logair problem the route structure, schedule, and assignment of aircraft historically have been determined via manual procedures. Currently it is not possible to verify the adequacy of the present system relative to an optimal network structure. Objective -this study addresses the problem of synthesizing a minimum cost transportation system plan to provide acceptable shipping times for transshipments among a set of points. The research objectives include development of solution approaches and assessment of computation time necessary to solve problems of realistic size. How work contributes - a combination of improved interfacing among routes, better scheduling, and alternative aircraft assignments would significantly alleviate certain performance deficiencies. In particular, 'pipeline' times are considered excessive in light of both customer service standards and the resultant 'inventory float' investment.

Research is proposed to continue algorithm development initiated during the 1976 usaf/asee summer faculty program. A unique formulation allows system modeling as a mixed integer linear program. The proposed solution approach applies bender's decomposition principle to obtain 0,1 integer master problem which designs the network and a linear programming subproblem which prescribes material flows. Primary thrust of the research is to develop a solution algorithm which exploits the special structure of the master problem to achieve reasonable computation time. The general approach indicated includes potential steps to simplify problem complexity, use of bounds available from decomposition and the relaxed problem.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, SPECTROPHOTOMETRY OF PLANETS, SATELLITES AND ASTEROIDS
M.G. TOMASKO, Univ. of Arizona, Graduate School, *Tucson, Arizona* 85721 (NSG 5249)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0002, ROTATION MODULATION COLLIMATOR EXPERIMENT STUDIES - SAS-3
C.S. BOWYER, Univ. of California, School of Letters & Science, *Berkeley, California* 94720 (NSG 5227)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0003, A THREE-DIMENSIONAL OBSERVATIONAL STUDY OF THE SOLAR FIVE-MINUTE OSCILLATION
R.K. ULRICH, Univ. of California, School of Letters & Science, *Los Angeles, California* 90024 (NSG 7407)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0004, A SPECTROSCOPIC STUDY OF O-TYPE STARS
P.S. CONTI, Univ. of Colorado, School of Arts & Sciences, *Boulder, Colorado* 80302 (AST76-20842 A01)

Support is for continued spectroscopic research on the O-type stars, the hottest, brightest, and most massive of all stars. These stars must be very young on a cosmic time scale since they pour out energy at a large rate (100,000 to one million times the energy output of the sun). Radiation ionizes the immediate stellar neighborhood. O-stars are important for the formation and early evolution of other nearby stars. Recently, it has been realized that all O-type stars lose mass. For the most luminous ones, gas flows out at such a rate that the outer atmosphere of the star is substantially modified. This 'stellar wind' not only influences the immediate surroundings, but also substantially affects the subsequent evolution of the O-type star itself. A first study is of phenomena present in the stellar winds as evidenced by the emission and absorption line profiles. This will give specific data about the mass-loss mechanism and the physical phenomena observed in the stellar winds. The second aspect will be to determine stellar masses by investigations of O-type binary star systems. The determination of the fundamental parameter of stellar mass has overriding importance in understanding of the evolution of these very luminous stars.

Prior support was by NSF grant AST 76-20842.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0005, ANALYSIS OF ULTRAVIOLET SPECTROMETRIC DATA FROM COPERNICUS
T.P. SNOW, Univ. of Colorado, School of Arts & Sciences, *Boulder, Colorado* 80302 (NSG 5246)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0006, NAVIGATION--POSITIONS AND INTENSITIES OF GALACTIC RADIO SOURCES
G.W. WETHERILL, Carnegie Inst. of Washington, *Washington, District of Columbia* 20005 (DN524402; N00014-76-C-1041)

Knowledge of positions, intensities and other properties of galactic radio sources is required for the design and development of advanced naval communications and navigation systems. A radio telescope at Derwood, Maryland, is used for this purpose.

To study hydrogen and other gas concentrations around galactic stars, and to understand the role of these gases in stellar birth and evolution. These studies are accomplished by use of a large parabolic antenna collector, and subject equipment is being used as a counterweight for the parabolic reflector. Knowledge of the galaxy gained from this research will lead to improved navigation capabilities.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

10.0007, NAVIGATION--POSITIONS OF SUBLUMINOUS STARS AND RADIO SOURCES
R.S. HARINGTON, U.S. Navy, Observatory, *Washington, District of Columbia* 20390 (DN046003)

Astronomical observations for the purpose of determining the motions and distances of stars constitute fundamental inputs to navigation, guidance, and the determination of time in which the Naval Observatory has a Department of Defense-directed requirement.

Photographic observations of subluminous stars and optical counterparts of X-ray sources are carried out with the Navy's largest telescope, a 61-inch astrometric reflector, which is located at the Flagstaff Station, Flagstaff, Arizona. Two automatic measuring machines in Washington are used to derive positions from the photographic material.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Observatory

10.0008, DETERMINATION OF THE MOTION OF THE MOON
T.C. VANFLANDERN, U.S. Navy, Observatory, *Washington, District of Columbia* 20390 (DN546001)

Support and augment the technical/operational programs and activities of the Naval Observatory in accordance with its Navy and Department of Defense mission on navigation and time determination by improving the constants of the moon and its reference system from analysis of observations.

Occultation data, precise lunar photographs, solar eclipse timings, laser ranging measurements and meridian circle observations of the moon will be analyzed for the motion of the moon, the ephemeris time scale and reference coordinate system corrections.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Observatory

10.0009, MULTISPECTRAL SENSORS AND THE DISCRIMINATION OF SOURCES
C.P. TSOKOS, State University of Fla. Sys., School of Natural Sciences, *Tampa, Florida* 33620 (NSG 1487)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0010, DETERMINATION OF COSMIC ABUNDANCE OF BORON
A.M. BOESGARRD, Univ. of Hawaii, School of Arts & Sciences, *Honolulu, Hawaii* 96822 (NSG 5231)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0011, RESEARCH ON SOLAR CORONAL ACTIVITY
M.K. MCCABE, Univ. of Hawaii, Inst. for Astronomy, *Honolulu, Hawaii* 96822 (ATM76-10323 A02)

This grant will continue support of research on solar coronal activity at the University of Hawaii. This support has permitted the development of a technique for deriving whole sun infrared maps in the spectral line Me I 10830 that show coronal holes clearly. With this technique it is possible to obtain detailed time-series observations of structure, velocity and brightness fluctuations in the photosphere and chromosphere underlying holes, quiet regions and active regions.

The research objective of this grant is to use the 10830 maps to study the morphology and evolution of holes and other large-scale solar features. A further objective is to make a detailed

study of the fine structure, velocity and brightness fluctuations, and the systematic velocity fields underlying holes, quiet regions and active regions at the photospheric and chromospheric levels. A major aim of this work is to understand the deposition of wave energy and momentum in coronal holes as contrasted with quiet and active regions. These observations will be used to develop improved methods for detecting holes using ground-based chromospheric observations.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0012, FAINT PHOTOELECTRIC PHOTOMETRIC STANDARD STAR SEQUENCES
A.U. LANDOLT, Louisiana State Univ. Systems, School of Science, *Baton Rouge, Louisiana* 70803 (DF047270; AF-AFOSR-3218-77)

AF function - reconnaissance and surveillance of spacecraft. Deficiency - lack of photometric calibration of faint stars to verify detection performance of optical surveillance systems. Objective - to establish photometric standards for stars in magnitude interval 12 and 17 over as wide a range of color index as possible. Contribution - faint standard stars will permit the calibration of detectors now in use or under development.

UBV (ultraviolet, blue, visual) photoelectric photometric standard star sequences will be established in eight selected areas along the celestial equator. Additional sequences will be established in known regions of the sky at 2.5 hour intervals in right ascension at -45 degrees declination.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

10.0013, OBSERVATION OF LOCAL INTERSTELLAR HYDROGEN USING COPERNICUS
H.W. MOOS, Johns Hopkins University, School of Arts & Sciences, *Baltimore, Maryland* 21218 (NSG 5230)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0014, RESEARCH OF IMAGE MOTION AND EVALUATION AND OPTIMIZATION OF THE AUTOMATIC GUIDE SYSTEM ON THE FORTY-EIGHT INCH TELESCOPE
D.G. CURRIE, Univ. of Maryland, School of Engineering, *College Park, Maryland* 20740 (NSG 5234)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0015, STUDIES OF SELECTED SOFT X-RAY SOURCES
A.K. DUPREE, Harvard University, School of Arts & Sciences, *Cambridge, Massachusetts* 02138 (NSG 5226)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0016, ULTRAVIOLET INVESTIGATIONS OF STELLAR X-RAY SOURCES
A.K. DUPREE, Harvard University, School of Arts & Sciences, *Cambridge, Massachusetts* 02138 (NSG 5229)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0017, OBSERVATIONS OF STELLAR CHROMOSPHERES AND CORONAE
A.K. DUPREE, Harvard University, School of Arts & Sciences, *Cambridge, Massachusetts* 02138 (NSG 5239)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0018, THEORETICAL ASTROPHYSICS AND COSMOLOGY
P. MORRISON, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (AST77-22907)

Research on a number of topics in theoretical astrophysics and cosmology will be carried out. The main areas of study include: 1) neutron star properties including equations of state, possible quark-nucleon phase transitions, and neutrino cooling; 2) thermal and non-thermal radiation from white dwarfs, including further consequences of our 'bloated dwarf' model of novae; 3) models of slow ('transient') and fast ('burst') variable galactic X-ray sources; 4) physics of supernova explosions, particularly acceleration of cosmic rays by the initial event; 5) double radio source ejection from active galaxy nuclei, and further study of the radiation from galactic nuclei themselves; 6) physical cosmology, including physical models of a 'cosmological constant', and constraints on variation in microscopic fundamental 'constants' set by observations of distant objects; and 7) astrophysical process, particularly magnetic field generation and annihilation in stars and in the less dense plasmas found in supernova remnants and double radio sources. There will be a cooperative program carried out with Dr. A. Cavaliere of the Institute of Astronomy of the University of Padua, Italy.

This is a continuation of research done under grant AST 74-19213 AO2.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0019, OBSERVATIONAL RESEARCH ON THE IUE SATELLITE
E.B. JENKINS, Princeton University, Graduate School, *Princeton, New Jersey* 08540 (NSG 5248)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0020, STUDY OF THE SPECTRUM OF COSMIC-RAY DECREASES AND OF LARGE-SCALE STRUCTURES IN THE SOLAR WIND
S.A. KORFF, New York University, School of Arts & Sciences, *New York, New York* 10012 (ATM77-07095)

This grant supports a study of the interaction of galactic cosmic-ray particles with the large-scale disturbances and inhomogeneities in the solar wind. The variations in the charge and energy spectrum of the cosmic radiation during transient intensity variations will be analyzed and the characteristics of the cosmic-ray decrease will be examined to determine how different solar-interplanetary structures affect the cosmic-ray distributions. Such structures include both evolving and quasistationary configurations, such as flare-generated shock waves and corotating streams. A preliminary investigation has shown systematic differences in the spectrum of variation of cosmic-ray protons above 1-2 GeV per nucleon, depending on the parameters that describe the sun and the interplanetary medium. The study will include the transient variations in the charge and rigidity spectrum of galactic cosmic rays below 550 GeV per nucleon, measured on the satellites Imps 6, 7, and 8, as an additional probe of the particle-field interactions. The parameters which describe the cosmic-ray decrease and the parameters which describe the state of the sun and of solar emissions, including flare ejecta, the solar wind, and the interplanetary magnetic field, will be examined both on the basis of individual events and in a multivariate analysis of all observed events. This procedure is planned to improve our understanding of the physical processes involved in the cosmic-ray decrease and of the large-scale interplanetary structures. The overall objective is to improve our understanding of solar-terrestrial relations as manifested by disturbances in the solar wind.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0021, SOLAR NEUTRONS
G.M. FRYE, Case Western Reserve Univ., School of Science, *Cleveland, Ohio* 44106 (ATM77-24836)

This grant will support a research program to investigate neutrons emitted by the sun during solar flares. The EOSCOR (Extended Observation of Solar and Cosmic Radiation) detector is designed to have large area, good detection efficiency, and low enough weight to be compatible with a superpressure balloon. A tandem zero pressure-superpressure balloon system has recently been successfully tested at National Scientific Balloon Facility (NSBF), and the initial round-the-world test flight is scheduled for Australia in Jan., 1978. A scientific payload capability of 250 lbs. is available to Case Western Reserve University and the University of Melbourne for this test flight. The present grant will permit the modification to the EOSCOR detector for the special conditions of the test flight, participation in the flight itself, and the analysis of the data.

The overall aim of the project is to detect neutrons emitted by solar flares in order to understand the energization of the flare process.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0022, EXPLORATORY OBSERVATIONS OF THE ULTRAVIOLET SPECTRA OF LATE-TYPE STARS
R.F. WING, Ohio State University, School of Arts & Sciences, *Columbus, Ohio* 43210 (NSG 5247)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0023, COPERNICUS SATELLITE OBSERVATIONS OF RAMAN SCATTERED LYMAN-ALPHA RADIATION
L.M. TRAFTON, Univ. of Texas, School of Natural Sciences, *Austin, Texas* 78712 (NSG 5236)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0024, ULTRAVIOLET SPECTROSCOPY OF X-RAY EMITTING BINARY SYSTEMS AND ULTRAVIOLET OBSERVATIONS OF INTERSTELLAR MOLECULES
P.A. VANDENBOUT, Univ. of Texas, School of Natural Sciences, *Austin, Texas* 78712 (NSG 5233)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0025, LINE IDENTIFICATION IN A STARS - TERMINATION OF HYDROGEN CONVECTION
E. BOHMVITENSE, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (NSG 5240)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0026, INTERSTELLAR LYMAN ALPHA OBSERVATIONS WITH THE IUE SATELLITE
B.D. SAVAGE, Univ. of Wisconsin, School of Letters & Science, *Madison, Wisconsin* 53706 (NSG 5241)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

GENERAL

11.0001, DEVELOP STANDARD TECHNIQUES FOR ANALYSIS OF AIR TRAFFIC IN NATIONAL AIRSPACE SYSTEM
L.B. WARD, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234 (FA76WAI-594; FA59551 (TRAIS NO.))

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

11.0002, AERONAUTICS AND SPACE SYMPOSIUM
UNKNOWN, Pratt Institute, Graduate School, *Brooklyn, New York* 11205 (NASW 3142)

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01 AERONAUTICS (GENERAL)

N78-23045* + National Aeronautics and Space Administration, Washington, D. C.
A CUMULATIVE INDEX TO AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY
Jan. 1978 632 p This cumulative index supersedes the indexes contained in supplements SP-7037(80) through SP-7037(91) (NASA-SP-7037(92)) Avail: NTIS HC E05 CSCL 01A

This publication is a cumulative index to the abstracts contained in NASA SP-7037 (80) through NASA SP-7037 (91) of Aeronautical Engineering: A Special Bibliography. NASA SP-7037 and its supplements have been compiled through the cooperative efforts of the American Institute of Aeronautics (AIAA) and Space Administration (NASA). This cumulative index includes subject, personal author, corporate source, contract, and report number indexes. Author

N78-23046*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ESTIMATING AIRLINE OPERATING COSTS
Dal V. Maddalon May 1978 25 p Presented at the CTOL Transport Technol. Conf., Hampton, Va., 28 Feb. - 3 Mar. 1978 (NASA-TM-78694; L-12255) Avail: NTIS HC A02/MF A01 CSCL 02A

A review was made of the factors affecting commercial aircraft operating and delay costs. From this work, an airline operating cost model was developed which includes a method for estimating the labor and material costs of individual airframe maintenance systems. The model, similar in some respects to the standard Air Transport Association of America (ATA) Direct Operating Cost Model, permits estimates of aircraft-related costs not now included in the standard ATA model (e.g., aircraft service, landing fees, flight attendants, and control fees). A study of the cost of aircraft delay was also made and a method for estimating the cost of certain types of airline delay is described. Author

N78-23047*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROGRESS IN SUPERSONIC CRUISE AIRCRAFT TECHNOLOGY
Cornelius Driver May 1978 19 p refs Presented at the CTOL Transport Tech. Conf., Hampton, Va., 28 Feb. - 3 Mar. 1978
(NASA-TM-78695; L-12274) Avail: NTIS HC A02/MF A01 CSCL 02A

The Supersonic Cruise Aircraft Resarch (SCAR) program identified significant improvements in the technology areas of propulsion, aerodynamics, structures, take-off and landing procedures, and advanced configuration concepts. A brief overview of the highlights of the NASA supersonic technology program is presented. Author

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N78-23048 Georgia Inst. of Tech., Atlanta.
AN IMPLICIT FINITE DIFFERENCE PROCEDURE FOR THE LAMINAR, SUPERSONIC BASE FLOW Ph.D. Thesis
Robert Landon Roach 1977 134 p
Avail: Univ. Microfilms Order No. 78-04527

The numerical method applies a time linearization and the Douglas-Gunn Alternating Direction Implicit (ADI) procedure to the Navier-Stokes equation. The differential equations were written in the conservation form, and the finite difference equations were derived by the cell integration technique. Several new forms of boundary conditions were required for stable and accurate solutions. In the (nearly) steady state conditions, net mass inflow rate differed from net mass outflow rate by 1.8% or less. No artificial viscosity was used in obtaining these solutions. The ability to increase the size of the timestep during computation was demonstrated. The final solution was insensitive to the initial conditions, but the time to convergence was highly dependent on initial conditions. Accuracy of the coarse mesh results was shown by comparisons with the fine mesh solution.
Dissert. Abstr.

N78-23049 Georgia Inst. of Tech., Atlanta.
NUMERICAL STUDY OF LAMINAR UNSTEADY FLOW OVER AIRFOILS Ph.D. Thesis
Narayanamoorthy Lakshmi Sankar 1977 207 p
Avail: Univ. Microfilms Order No. 78-04528

A numerical scheme for the solution of two dimensional incompressible Navier-Stokes equations was developed with special emphasis on laminar flow around oscillating airfoils. An explicit integral relationship was used to determine the velocity field in terms of vorticity and velocity boundary conditions. The accuracy and the flexibility of the method were demonstrated by considering two test cases involving bodies of simple geometry. The method was applied to the study of viscous flow over an oscillating Joukowski 12% airfoil. The viscous drag coefficient was found to be the chief contributor to the total drag whenever the separated flow region on the upper surface of the airfoil was not appreciably large. Dissert. Abstr.

N78-23050 Georgia Inst. of Tech., Atlanta.
PRESSURE MEASUREMENTS NEAR THE TIP OF A HOVERING MODEL ROTOR BLADE AND A PRELIMINARY INVESTIGATION OF THE FLOW IN THE ROTOR WAKE Ph.D. Thesis
Tumkur Parameswaraiah Shivananda 1977 212 p
Avail: Univ. Microfilms Order No. 78-04529

Pressure measurements were made over the tip region of a hovering rotor blade with the aim of understanding more about the generation of the tip vortex. Blade tip surface pressures

were measured in detail for blade pitch angles of 0 deg, 6.2 deg, and 11.4 deg. These angles correspond to thrust coefficients of 0, 0.0026, and 0.0055. The pressure measurements were made at six radial stations outboard of the 94% radial location on the rotor blade. At 0 deg pitch angle, the measured pressure distribution in the tip region was in good agreement with the pressure distribution obtained from semi-infinite wing theory. Instantaneous velocity components were measured in detail in the near-wake of the rotor at several radial and axial stations by using a hot-film vector anemometer. Dissert. Abstr.

N78-23051*# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.

INDEX FOR AERODYNAMIC DATA FROM THE BUMBLEBEE PROGRAM

L. L. Cronvich and G. A. Barnes Apr. 1978 83 p refs
(NASA Order L-60036A)
(NASA-CR-145347) Avail: NTIS HC A05/MF A01 CSCL 01A

The Bumblebee program, was designed to provide a supersonic guided missile. The aerodynamics program included a fundamental research effort in supersonic aerodynamics as well as a design task in developing both test vehicles and prototypes of tactical missiles. An index of aerodynamic missile data developed in this program is presented. Author

N78-23052*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EXPERIMENTAL RESULTS OF WINGLETS ON FIRST, SECOND, AND THIRD GENERATION JET TRANSPORTS

Stuart G. Flechner and Peter F. Jacobs May 1978 19 p refs
Presented at the CTOL Transport Tech. Conf., Hampton, Va., 28 Feb. - 3 Mar. 1978
(NASA-TM-72674; L-12263) Avail: NTIS HC A02/MF A01 CSCL 01A

The results of wind tunnel investigations of winglets on four jet transport configurations are presented. Performance and wing root bending moment data were given. Additionally, detailed aerodynamic characteristics are presented at the design condition and also at several off design conditions for one configuration. Results of the investigations indicate that the winglets improve the cruise lift to drag ratio between 4 and 8 percent. These data also show that the ratios of relative aerodynamic gain to relative structural weight penalty for winglets are 1.5 to 2.5 times the ratios for wing tip extensions. The comprehensive investigation of the effects of winglets indicated that winglets produce no adverse effects on buffet onset, lateral directional stability, and aileron control effectiveness. Author

N78-23053*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

PRELIMINARY AERODYNAMIC CALIBRATION OF THE SPINNING MODE SYNTHESIZER FLOW DUCT FACILITY

Richard J. Silcox Apr. 1978 28 p refs
(NASA-TM-78675) Avail: NTIS HC A03/MF A01 CSCL 01A

Results of the initial aerodynamic calibration of the spinning mode synthesizer flow duct facility in the Aircraft Noise Reduction Laboratory are presented. The system is shown to be operable over an inlet Mach number range of zero to 0.6. Mach number profiles are presented at several axial stations along the duct. Diffuser performance is reviewed. Spatial and temporal variations are discussed. Author

N78-23054*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A COMPUTER PROGRAM FOR CALCULATING SYMMETRICAL AERODYNAMIC CHARACTERISTICS AND LATERAL-DIRECTIONAL STABILITY DERIVATIVES OF WING-BODY COMBINATIONS WITH BLOWING JETS

C. Edward Lan (Kansas Univ., Lawrence), Sudhir C. Mehrotra (Kansas Univ., Lawrence), and Charles Fox Mar. 1978 177 p refs
(NASA-TM-78684) Avail: NTIS HC A09/MF A01 CSCL 01A

The necessary information for using a computer program to calculate the aerodynamic characteristics under symmetrical flight conditions and the lateral-directional stability derivatives of wing-body combinations with upper-surface-blowing (USB) or over-wing-blowing (OWB) jets are described. The following new features were added to the program: (1) a fuselage of arbitrary body of revolution has been included. The effect of wing-body interference can now be investigated, and (2) all nine lateral-directional stability derivatives can be calculated. The program is written in FORTRAN language and runs on CDC Cyber 175 and Honeywell 66/60 computers. Author

N78-23055# Institut de Mecanique des Fluides de Marseille (France).

SURFACE FLOW FIELD FOR A TURBULENT BOUNDARY LAYER AROUND A YAWED CONE AT M SUB INFINITY = 5

Patrick Bontoux, Pierre Massot, and Jacques Marcillat 9 Aug. 1977 29 p refs Backup document for AIAA Synoptic, "Turbulent Surface Flow Around a Yawed Cone", scheduled for publication in AIAA Journal in Aug. 1978
Avail: NTIS HC A03/MF A01

The three dimensional turbulent boundary layer around a cone placed at angle of attack in a supersonic stream was studied experimentally and theoretically. Results presented concern the limiting flow at the wall of a 7.5 deg half angle cone at infinity = 5. The limiting streamlines direction alpha sub p were measured from the surface oil flow patterns obtained for a wide range of incidence, so that the effect of incidence on alpha sub p can be clearly shown. The numerical calculations were conducted in the nonseparated region of the boundary layer. The turbulent viscosity concept and the y/delta similarity assumption were used to resolve the Prandtl boundary equations. The predictions obtained with four different laws were compared with the experimental results and are found to be in agreement with these results, except in the neighborhood of the boundary layer separation. Author

N78-23056*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.

FLIGHT-MEASURED BUFFET CHARACTERISTICS OF A SUPERCRITICAL WING AND A CONVENTIONAL WING ON A VARIABLE-SWEEP AIRPLANE

Richard C. Monaghan May 1978 39 p refs
(NASA-TP-1244; H-991) Avail: NTIS HC A03/MF A01 CSCL 01A

Windup-turn maneuvers were performed to assess the buffet characteristics of the F-111A aircraft and the same aircraft with a supercritical wing, which is referred to as the F-111 transonic aircraft technology (TACT) aircraft. Data were gathered at wing sweep angles of 26, 35, and 58 deg for Mach numbers from 0.60 to 0.95. Wingtip accelerometer data were the primary source of buffet information. The analysis was supported by wing strain-gage and pressure data taken in flight, and by oil-flow photographs taken during tests of a wind tunnel model. In the transonic speed range, the overall buffet characteristics of the aircraft having a supercritical wing are significantly improved over those of the aircraft having a conventional wing. Author

N78-23057# ARO, Inc., Arnold Air Force Station, Tenn.

ARTIFICIALLY INDUCED BOUNDARY-LAYER TRANSITION ON BLUNT-SLENDER CONES USING DISTRIBUTED ROUGHNESS AND SPHERICAL-TYPE TRIPPING DEVICES AT HYPERSONIC SPEEDS Final Report, 30 Oct. 1976 - 30 Sep. 1977

A. H. Boudreau Feb. 1978 50 p refs
(AD-A052034; AEDC-TR-77-120) Avail: NTIS HC A03/MF A01 CSCL 16/3

Research directed toward establishing criteria for distributed roughness-type boundary-layer trips on blunt-slender cones has been conducted in the AEDC/VKF at Mach numbers from 8 to 13. Results indicate that distributed roughness trips are superior to spherical-type trips in that equally effective distributed roughness trips are one-fifth as high and produce substantially smaller flow-field disturbances. Criteria are defined for optimum utilization of distributed roughness trips. Author (GRA)

N78-23058# General Dynamics/Convair, San Diego, Calif.

SOME NUMERICAL SOLUTIONS OF INVISCID, UNSTEADY, TRANSONIC FLOWS OVER THE NLR 7301 AIRFOIL Final Report

R. J. Magnus Jan. 1978 45 p refs
(Contract N00014-77-C-0051)

(AD-A051837; CASD-LVP-78-013) Avail: NTIS HC A03/MF A01 CSCL 20/4

Inviscid transonic flows over the NLR 7301 airfoil were calculated using a program based on the unsteady Euler equations. The six cases treated include a subsonic flow, a near-shockless supercritical flow and some supercritical flows with shocks. In each case, steady flows and unsteady flows for pitching oscillations with 0.5 degree amplitude and reduced frequency (k = omega C/2U sub infinity) of approximately 0.2 were calculated.

Author (GRA)

N78-23059# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SUPERSONIC FLOW-AROUND OF THIN BODIES WITH MACH NUMBER CLOSE TO UNITY

G. F. Sigalov 20 Dec. 1977 6 p refs Transl. into ENGLISH from Dopov. Akad. Nauk Ukr. RSR, Ser. A (Kiev), v. 33, no. 11, 1977 p 1023-1027

(AD-A051884; FTD-ID(RS)T-1784-77) Avail: NTIS HC A02/MF A01 CSCL 20/4

Problem solving of full approximation of non-linear differential equation of supersonic gas dynamics in a physical space is investigated by means of linear equation of space approximation.

Author (GRA)

N78-23060# ARO, Inc., Arnold Air Force Station, Tenn.

AN AERODYNAMIC COEFFICIENT PREDICTION TECHNIQUE FOR SLENDER BODIES WITH LOW ASPECT RATIO FINS AT MACH NUMBERS FROM 0.6 TO 3.0 AND ANGLES OF ATTACK FROM 0 TO 180 DEGREES Final Report, 1 Jul. 1974 - 1 Aug. 1977

William B. Baker, Jr. Mar. 1978 361 p refs

(AD-A051797; AEDC-TR-77-97) Avail: NTIS HC A16/MF A01 CSCL 20/4

In order to extend the state-of-the-art aerodynamic coefficient prediction methodology at high angles of attack, a semi-empirical prediction technique has been developed for the prediction of normal force and pitching moment coefficients for slender body alone and slender body plus fin configurations. Additionally, installed fin normal force, root bending and hinge moment coefficients are calculated. The semi-empirical prediction technique is valid for slender bodies with low aspect ratio fins at Mach numbers from 0.6 to 3.0 and angles of attack from 0 to 180 degrees. The range of validity of the prediction technique for the low aspect ratio fins is: aspect ratio from 0.5 to 2.0; taper ratio from 0 to 1.0 and span ratio from 0.3 to 0.5. Wind tunnel testing was accomplished in order to provide the data base from which the prediction technique was derived. The data base provides the first parametric set of data at angles of attack, from 0 to 180 degrees, and not only provided the base for the semi-empirical prediction technique developed herein, but will provide a standard of comparison for high angle of attack prediction methodology developed in the future.

Author (GRA)

N78-23061# General Applied Science Labs., Inc., Westbury, N. Y.

AN INVESTIGATION OF WALL AND BACK PRESSURE EFFECTS IN TRANSONIC INTERFERENCE Final Report

Sheldon Elzweig and Paolo Baronti Jun. 1977 45 p refs

(Contract N00014-76-C-0149)

(AD-A052167; GASL-TR-245) Avail: NTIS HC A03/MF A01 CSCL 20/4

An approximate method for the determination of tunnel wall interference on two-dimensional non-lifting supercritical airfoils is presented. The method assumes classical linearized subsonic interference theory applied to an airfoil whose thickness is increased so as to match the far field transonic velocity potential. The interference potential at the wing trailing edge is taken as the parameter controlling the shock location on the airfoil. Sample computations of circular arc airfoils in tunnels with solid, porous and slotted walls are shown to adequately predict the shock displacement produced by the wall constraints. Also presented is a numerical analysis, based on a shock fitting technique, for the determination of exact shape and location of imbedded shocks. With the analysis and accompanying numerical code some results are provided to show the sensitivity of back pressure perturbations on shock location.

Author (GRA)

N78-23062# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

METHOD OF CALCULATION OF NONSTATIONARY AERODYNAMIC CHARACTERISTICS OF A LOW-FLYING WING WITH A CYLINDRICAL FUSELAGE

L. G. Tsvetkov 20 Oct. 1977 17 p refs Transl. into ENGLISH from Tr. Leningrad. Koroblestroitelnogo Inst. (USSR), no. 80, 1972 p 115-123

(AD-A051978; FTD-ID(RS)T-1818-77) Avail: NTIS HC A02/MF A01 CSCL 20/4

Algebraic formulas are derived for determining the velocities of various horseshoe-shaped vortices on the wing. Zhukovskiy formulas are then used to determine the total aerodynamic characteristics of a lifting wing with a cylindrical fuselage.A.R.H.

N78-23063# Texas A&M Univ., College Station.

FLUTTER ANALYSIS OF A CASCADE OF STAGGERED BLADES IN SUBSONIC FLOW M.S. Thesis

Louis Kronenberger, Jr. Dec. 1977 76 p refs Sponsored by Army

(AD-A051240) Avail: NTIS HC A05/MF A01 CSCL 20/4

The purpose of this report is to utilize a numerical lifting surface theory developed by Rao and Jones to predict the unsteady airloads on an infinite cascade of staggered blades in subsonic compressible flow. An investigation is conducted to determine the effect on the unsteady airloads when parameters such as reduced frequency, interblade stagger angle, interblade spacing, and interblade phase lag are varied over a specific range of values. Once the unsteady airloads have been determined, they are used to perform an aeroelastic analysis of the staggered cascade for a single degree of freedom in torsion and a two degree of freedom system in bending and torsion. Results of the single degree of freedom analysis yields flutter boundaries. A new general flutter program is developed for the two degree of freedom system. The iterative procedure of the flutter program yields the flutter frequency and speed of the cascade reference airfoil as a function of the cascade parameters.

GRA

N78-23064# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.

THE PERFORMANCE OF A CONCEPTUAL MULTIMISSION POWER-AUGMENTED-RAM WING-IN-GROUND EFFECT VEHICLE Final Report, Jun. - Sep. 1977

Basil S. Papadales, Jr. Sep. 1977 40 p refs

(AD-A051433; DTNSRDC/ASED-395) Avail: NTIS HC A03/MF A01 CSCL 01/3

Results of a conceptual design study of a power augmented ram wing-in-ground effect vehicle are presented. The vehicle is designed for sea control operations. Four vertical/short takeoff and landing aircraft are carried for these operations. Alternative payloads designed for transoceanic transport, strategic deterrence, and theater air defense missions are investigated. Vehicle performance for the various operations is shown to provide a unique military capability assuming reasonable advances in power augmented ram wing-in-ground effect technology. Author (GRA)

N78-23065# Akron Univ., Ohio. Dept. of Mechanical Engineering.

DEVELOPMENT OF A METHOD FOR PREDICTING SUBSONIC TURBULENT SEPARATING BOUNDARY LAYERS Final Report, 1 Sep. 1974 - 31 Dec. 1977

Philip M. Gerhart and Rodrick V. Chima Feb. 1978 172 p refs

(Grants DAHC04-75-G-0026; DAAG29-77-G-0030)

(AD-A051535; ARO-12437.1-E) Avail: NTIS HC A08/MF A01 CSCL 20/4

An attempt is made to develop a method for predicting subsonic flows exhibiting pressure gradient induced turbulent boundary layer separation. The concept of a strong interaction between rotational (viscous) layer near a body and an external irrotational flow is adopted. The boundary layer approximations to the equations of motion are retained in the viscous layer; mathematical coupling between the flow regions is introduced by requiring continuity of flow speed (or Mach number) and direction. An integral method is used to solve the boundary layer equations; the equations are set up so that either flow speed or angle can be calculated, given the other. A modification of the wall-wake velocity profile valid for compressible flow is

used together with an algebraic non-equilibrium turbulence model. Equations solved are the integral continuity, momentum, and moment of momentum equations. Predictions for compressible and incompressible plane two-dimensional separating and reattaching boundary layers are quite good when edge speed or angle are available from experimental data. GRA

N78-23066# Sandia Corp., Livermore, Calif. Advanced Mechanical Div.

PARACHUTE THAT GOES UP

R. E. Rychnovsky 1977 4 p refs Presented at 15th SAFE Symp., Las Vegas, Nev., 4 Dec. 1977

(Contract EY-76-C-04-0789)

(SAND-77-8704; Conf-771215-1) Avail: NTIS HC A02/MF A01

A two-stage lifting parachute system was developed for very-low-altitude deliveries. The lifting parachute slows and lifts the payload above the release altitude. The second stage is deployed above the release altitude and has time to slow the payload to its terminal velocity and turn the system to a nearly vertical angle at impact. The parachute system reduces the impact energy of a payload to one-tenth that of a conventional single stage system. Development tests of the lifting parachute have included tests from Mach 0.45 to Mach 1.25 with deliveries as low as 85 ft above the ground level. The payload was lifted as much as 240 ft in these tests. Computer simulations show that the lifting parachute could lift a payload more than 500 ft for high subsonic velocities. The parachute in terminal descent will glide horizontally one foot for each two feet of vertical descent. ERA

N78-23067# Royal Aircraft Establishment, Farnborough (England). Structures Dept.

THEORETICAL DETERMINATION OF SUBSONIC OSCILLATORY AIRFORCE COEFFICIENTS

D. E. Davies London Aeron. Res. Council 1978 116 p refs Supersedes RAE-TR-76059; ARC-36914

(ARC-R/M-3804; RAE-TR-76059; ARC-36914) Avail: NTIS HC A06/MF A01; HMSO £9; PHI $34.70

The theoretical method presented for the calculation of the linearized values of generalized airforce coefficients on a harmonically oscillating flat plate wing in subsonic flow is a further development of the lifting surface theory of Multhopp type, and has been justified mathematically. The method of spanwise integration is refined, and the number of upwash points taken may be greater than the number of basic functions used in the approximation for the loading. The refined method of spanwise integration leads to improved accuracy in the evaluated values of upwash, especially near the perimeter of the planform. By taking more upwash points than the number of basic loading functions more accurate values should be obtained for the generalized airforce coefficients for a given number of basic functions. The procedure was programmed in ICL 1900 FORTRAN. The program was used to obtain results for tapered swept and rectangular wings. Author (ESA)

N78-23068# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

VORTEX BREAKDOWN. SOME OBSERVATIONS IN FLIGHT ON THE HP 115 AIRCRAFT

L. J. Fennell London Aeron. Res. Council 1977 21 p refs Supersedes RAE-TR-71177; ARC-34400

(ARC-R/M-3805; RAE-TR-71177; ARC-34400) Avail: NTIS HC A02/MF A01; HMSO £3; PHI $11.55

A technique for observing flow in vortex cores in flight is presented and the results of flight tests to study vortex breakdown using the HP 115 aircraft are presented. ESA

N78-23069# European Space Agency, Paris (France).

THEORETICAL INVESTIGATION OF THE VISCID FLOW AROUND A FLAT PLATE WITH GROUND EFFECT

Wolfgang Geller Mar. 1978 31 p refs Transl. into ENGLISH of 'Theoretische Untersuch. der reibungsbehafteten Stroemung um eine ebene Platte mit Bodeneffekt', DFVLR, Cologne Report DLR-FB-77-35, 19 Aug. 1977 Original report in GERMAN previously announced as N78-18016 Original German report available from DFVLR, Cologne DM 14.10

(ESA-TT-468; DLR-FB-77-35) Avail: NTIS HC A03/MF A01

The incompressible laminar flow field past a flat plate with ground effect was calculated by numerical integration of the vorticity transport equation and the Poisson equation for the stream function. Results show that, for slot heights of 0.9 to 4% of the plate length and for a Reynolds number, related to the plate length and the velocity far upstream of the plate, of 1000, the flow in the slot between the plate and the moving ground is similar to a Couette flow with a small negative pressure gradient in the flow direction. The viscous effect of the flow produces a high pressure in the slot which generates a lifting force together with the low pressure on the upper surface of the plate. Author (ESA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N78-23070*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

FLIGHT EXPERIMENTS TO IMPROVE TERMINAL AREA OPERATIONS

Seymour Salmirs and Samuel A. Morello May 1978 31 p refs Presented at the CTOL Transport Tech. Conf., Hampton, Va., 28 Feb. - 3 Mar. 1978

(NASA-TM-78685; L-12235) Avail: NTIS HC A03/MF A01 CSCL 17G

A brief description is given of the objectives and activities of the terminal configured vehicle (TCV) program and of some of the airborne facilities. A short analysis of some particular problems of CTOL operations in the terminal area is also presented to show how the program's technical objectives are related to the defined problems. The test aircraft was flown both manually and automatically with manual monitoring over paths including 130 deg intercepts and 2.0 km (1.1. n. mi.) and 0.8 km (0.44 n. mi.) finals. Some statistical data are presented from these and other flight profiles designed to address specific terminal in the next biennium and their application to the terminal area. A description of work being undertaken to study the addition of adjacent traffic information to present map displays is also given. Author

N78-23071# Army Research and Technology Labs., Fort Eustis, Va.

A STUDY OF THE DESIRABILITY AND FEASIBILITY OF IN-FLIGHT ESCAPE FROM ARMY HELICOPTERS

John F. Tansey Nov. 1977 32 p refs

(DA Proj. 1L2-62209-AH-76)

(AD-A051153; USARTL-TN-27) Avail: NTIS HC A03/MF A01 CSCL 06/7

This report reviews the feasibility and desirability of helicopter emergency escape systems from the Army's viewpoint. Accident statistics, nap-of-the-earth flight, human reaction times, and crashworthy designs are considered, and the positions of various U.S. Army organizations are included. The escape systems reviewed include ejection and extraction seats, and passenger helicopter systems. Author (GRA)

N78-23072# Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.

SITUATION OF AIR TRAFFIC IN COMPARISON TO GROUND TRANSPORTATION NOTING ESPECIALLY ENERGETIC PROBLEMS [DIE SITUATION DES LUFTVERKEHRS IM VERGLEICH ZU DEN BODENGEBUNDENEN VERKEHRSMITTELN UNTER BESONDERER BERUECKSICHTIGUNG ENERGETISCHER PROBLEME]

K. Dieter Kricke 1977 191 p refs In GERMAN

(ILR-20; ISBN-3-7983-0588-9) Avail: NTIS HC A09/MF A01

The effects of increasing fuel costs on the future development of air traffic in competition with ground transportation were investigated, also taking into account other factors. Possibilities

of fuel economies by operational and technical savings measures are discussed, and limits in technical feasibility (effort) and economical effect (profits) are indicated. The effects of increasing fuel prices on the competitive position of air traffic vis-a-vis ground traffic are not considered serious from the present point of view, and limitations in future expansion of air traffic are not confirmed. ESA

N78-23073# Technische Universitaet, Brunswick (West Germany). Sonderforschungsbereich 58 - Flugfuehrung.
FLIGHT SAFETY HAZARDS BY SHEAR WINDS
Peter Krauspe Sep. 1977 22 p refs In GERMAN; ENGLISH summary
(TUBS/SFB58/62) Avail: NTIS HC A02/MF A01

The existing aircraft landing and takeoff procedures are examined in view of their wind shear compatibility. Meteorological wind shear is described from a flight technical point of view. Aircraft reactions to wind shear are outlined for several flight phases (landing-takeoff). The possibility of wind shear elimination is discussed and relevant effects to wind shear problems are reviewed. ESA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N78-23074# IIT Research Inst., Annapolis, Md.
PROPOSED METHODS AND CRITERIA FOR ATCRBS PRF ASSIGNMENT Final Report, 1974 - 1975
C. Randall Crawford Aug. 1976 47 p refs
(Contracts DOT-FA70-WAI-175; F19628-78-C-0006)
(AD-A050050/4; ECAC-PR-76-030; FAA-RD-77-89) Avail: NTIS HC A03/MF A01 CSCL 17/7

A model was designed to aid in selecting a pulse repetition frequency (PRF) for the air traffic control radar beacon system (ATCRBS). A discussion of the mechanisms of near synchronous interference and the various remedies available is presented. Both false target inducing near synchronous replies and transponder lockout were considered. Among the considerations for reducing near synchronous interference are pulse repetition period separations, distance separations between sites with like PRF's, staggered and jittered PRF's target detection parameter adjustments. Author

N78-23075# Rome Air Development Center, Griffiss AFB, N.Y.
ANALYSIS AND TEST OF THE REDUCED HEIGHT PERFORMANCE OF THE AN/GRN-27 ILS SYSTEM COURSE AND CLEARANCE NEAR FIELD DETECTOR ANTENNAS
J. McIlvenna, C. Paprocki, C. Drane, and E. Christopher Nov. 1977 33 p refs
(AD-A051456; RADC-TR-77-392) Avail: NTIS HC A03/MF A01 CSCL 09/5

The report consists of three parts. The first is a computer analysis of the reduced height performance of a four-element Yagi antenna over a variety of real earth conditions. The second is a computer analysis of the Yagi antennas as near field detectors in the AN/GRN-27 ILS system. Coupled to this is an analysis and experimental check of the reduced height Yagi performance in the MRN-7 localizer antenna modification to the GRN-27 ILS system. The last part is an analysis and prediction of the Yagi performance in a second modification to the GRN-27 system that uses a log periodic type of a localizer antenna. Author (GRA)

N78-23076# Rome Air Development Center, Griffiss AFB, N.Y. Deputy for Electronic Technology.
USER'S GUIDE FOR ESD LORAN GRID PREDICTION PROGRAM
Samuel Horowitz Dec. 1977 88 p refs
(AD-A051186; RADC-TR-77-407) Avail: NTIS HC A05/MF A01 CSCL 17/7

The purpose of the LORAN Grid Prediction Computer program is to transform geographic coordinates into a LORAN time difference (TD). Utilizing available map data of terrain and lithology and applying an integral form of Maxwells' equations, the propagation time of a low frequency pulse over irregular and inhomogeneous ground can be calculated. The method of data tape production and TD calculation is described with program listings. The technique has been successfully used by several U.S. Government agencies. Author (GRA)

N78-23077# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
GEANS SOFTWARE ANALYSIS DEVELOPMENT AND VALIDATION Final Report, Nov. 1975 - Nov. 1976
William Mikulski and James E. Barnes Aug. 1977 79 p
(AF Proj. 1927)
(AD-A051519; AFAL-TR-77-119) Avail: NTIS HC A05/MF A01 CSCL 17/7

The GEANS Software Analysis Development and Validation effort consisted of writing an existing assembly language program in a high order language (HOL) and then comparing the two-load modules for memory requirements and timing. This comparison showed that the program as written in the HOL required more memory and time than the same program as written in assembly language. Author (GRA)

N78-23078# Standard Electrik Lorenz A.G., Stuttgart (West Germany).
DME-BASED SYSTEM FOR ENROUTE/TERMINAL NAVIGATION, ALL-WEATHER LANDING AND AIR TRAFFIC CONTROL
K. D. Eckert [1976] 13 p
Avail: NTIS HC A02/MF A01

The DME system, which has found wide spread worldwide application in the civil and military area as well, includes, due to its ingenious signal format and the very economic channeling scheme, a considerable potential for additional applications. Today's navigation and air traffic control systems have at least partly reached their limits of improvement and extension as the call for a Microwave Landing System (MLS) proves. The growth potential of the ICAO-standardized Distance Measuring Equipment (DME) allows for various operational extensions by improving the distance measuring system to Precision Distance Measuring System (PDME) and using DME interrogations by direction finders on the ground, measuring azimuth and elevation. The operational applications of these features are the DME-based Landing System (DLS), the FRGs contribution to the international MLS competition of ICAO, the additional use of the DLS-A ground subsystem as TMA-navaid, the extension of this principle to the enroute-navigation called DENS for DME-based Enroute Navigation System, the universal DLS/DME/DENS = DLENS airborne equipment, and last but not least the step into the ATC/CAS-field with DACS (DME-based Air traffic Control System). The paper explains the systematic and technical background of this aeronavigational system. An analysis of the various subsystems detailing these advantages compared to today's installations dealing with the areas of operational performance and economic efficiency mainly, is given. Author (ESA)

N78-24037# Joint Publications Research Service, Arlington, Va.
SELECTING THE SPACE OF STATES AND MEASUREMENTS IN PROBLEMS OF OPTIMUM CORRECTION OF INERTIAL NAVIGATION SYSTEMS
V. A. Karakashev, S. G. Romanenko, and A. S. Filippov *In its* Transl. on USSR Sci. and Technol. (JPRS-71181) 25 May 1978 p 33-40 refs Transl. into ENGLISH from Izv. Vysshykh Uchebn. Zavedenii Priborostr. (Leningrad), vol. 21, no. 2, 1978 p 76-82
(For availability see N78-24033 14-99)
Copyright. Avail: Issuing Activity

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.
For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N78-23079# Royal Aircraft Establishment, Farnborough (England).
APPLICATION OF THE DIRECT-CURRENT ELECTRICAL POTENTIAL METHOD IN FRACTURE MECHANICS
P. Stratmann and K. H. Bowe Oct. 1977 14 p refs Transl. into ENGLISH from Material Pruefung (West Ger.), v. 18, no. 9, 1976 p 339-341
(RAE-Lib-Trans-1940; BR62014) Avail: NTIS HC A02/MF A01

The determination of the depth of cracks using a direct current potential probe method is described. With the help of various technical measurement problems from the field of fracture mechanics, the possibilities and limitations of this method are discussed. It is shown how the accuracy of the method is improved and how the work expenditure associated with such type of measurement is reduced to a considerable degree by simple automation. Author

N78-23080*# Lockheed-California Co., Burbank.
FLIGHT SERVICE EVALUATION OF AN ADVANCED COMPOSITE EMPENNAGE COMPONENT ON COMMERCIAL TRANSPORT AIRCRAFT. PHASE 1: ENGINEERING DEVELOPMENT Final Report, 9 Jun. - 31 Dec. 1975
A. Ary, C. Axtell, L. Fogg, A. Jackson, A. James, B. Mosesian, J. Vanderwier, and J. VanHamersveld May 1976 199 p refs
(Contract NAS1-14000)
(NASA-CR-144986; LR-27543) Avail: NTIS HC A09/MF A01 CSCL 01C

The empennage component selected for this program is the vertical fin box of the L-1011 aircraft. The box structure extends from the fuselage production joint to the tip rib and includes the front and rear spars. Various design options were evaluated to arrive at a configuration which would offer the highest potential for satisfying program objectives. The preferred configuration selected consists of a hat-stiffened cover with molded integrally stiffened spars, aluminum trussed composite ribs, and composite miniwich web ribs with integrally molded caps. Material screening tests were performed to select an advanced composite material system for the Advanced Composite Vertical Fin (ACFV) that would meet the program requirements from the standpoint of quality, reproducibility, and cost. Preliminary weight and cost analysis were made, targets established, and tracking plans developed. These include FAA certification, ancillary test program, quality control, and structural integrity control plans. Author

N78-23081*# Mississippi State Univ., Mississippi State. Dept. of Aerophysics and Aerospace Engineering.
PILOT EVALUATION OF SAILPLANE HANDLING QUALITIES Final Report
A. G. Bennett, Jr. May 1978 91 p refs
(Grant NsG-1284)
(NASA-CR-2960) Avail: NTIS HC A05/MF A01 CSCL 01C

The evaluation sailplanes were found generally deficient in the area of cockpit layout. The pilots indicated general dissatisfaction with high pitch sensitivity especially when ctoupled with inertially induced stick forces. While all sailplanes were judged satisfactory for centering thermals and in the ease of speed control in circling flight, pilot opinions diverged on the maneuvering response, pull-out characteristics from a dive, and on phugoid damping. Lateral-directional control problems were noted mainly during takeoff and landing for most sailplanes with the landing wheel ahead of center of gravity. Pilot opinion of in-flight lateral-directional stability and control was generally satisfactory. Five of the evaluation sailplanes exhibited a very narrow airspeed band in which perceptible stall warning buffet occurred. However, this characteristic was considered not objectionable when stall recovery was easy. The pilots objected to the characteristics of a wide airspeed band of stall warning followed by a stall with yawing and rolling tendency and substantial loss of altitude during the stall. Glide path control for the evaluation sailplanes was found to be generally objectionable. Author

N78-23082# AiResearch Mfg. Co., Phoenix, Ariz.
EVALUATION OF A PRESSURIZED AIR START SYSTEM FOR ADVANCED ARMY HELICOPTERS Final Technical Report
J. A. Rhoden Nov. 1977 181 p
(Contract DAAJ02-77-C-0007; DA Proj. 1L2-62209-AH-76)
(AD-A051967; USAAMRDL-TR-77-46; AiResearch-41-1810A)
Avail: NTIS HC A09/MF A01 CSCL 21/5

This report presents the results of an evaluation of a pressurized air start system (PASS) for advanced Army helicopters. PASS is a new concept for starting gas turbine propulsion engines that currently use electric starters in conjunction with nickel-cadmium batteries. PASS is a stored energy start system using air as the working fluid. In addition to starting the engine by pressurized air, the engine can be started using pneumatic ground carts or bleed air from another engine. The study included a design evaluation of a PASS for both single- and twin-engine helicopters. In addition, a comparison of a PASS and an equivalent electric start system was made on the basis of performance, weight, reliability, maintainability, vulnerability, and life-cycle cost. The logistics of operating the PASS using current and planned ground support equipment was studied. The results of the comparison indicated that PASS offers the following improvements over electric starting: Engine start times can be reduced significantly; System weight is lower; Maintenance requirements can be reduced; Reliability is improved significantly; and Life-cycle cost can be reduced 30 to 40 percent.
Author (GRA)

N78-23083# Army Research and Technology Labs., Fort Eustis, Va.
A TECHNIQUE FOR MONITORING FLIGHT-TEST ENVELOPE EXPANSION Final Report
Donald N. Arents Dec. 1977 16 p refs
(DA Proj. 1L2-63211-D-157)
(AD-A051163; USARTL-TN-28) Avail: NTIS HC A02/MF A01 CSCL 01/3

A technique for monitoring flight-test envelope expansion is described. This 'Smart Book' technique was used for the successful helicopter mode envelope expansion of the XH-59A Advancing Blade Concept (ABC) technology demonstrator aircraft. The technique contributed to the safety and success of the XH-59A program, provided control over the envelope expansion, and constituted a technical focal point that enhanced coordination between the Government and contractor test team members.
Author (GRA)

N78-23084# Arinc Research Corp., Annapolis, Md.
SYSTEM CONFIGURATION TRADEOFF ANALYSIS FOR ARMY MINI-RPV PROGRAM
K. J. Braman and W. B. Stewart Jan. 1977 156 p refs
(Contract F33657-75-D-0329)
(AD-A051984; Rept-1282-01-1-1576) Avail: NTIS HC A08/MF A01 CSCL 01/3

A tradeoff analysis of equipment applicable to the U.S. Army Mini-RPV Program is described. Candidate equipments are evaluated and ranked for each subsystem of the remotely piloted vehicle, from which alternative complete systems ('baseline' and 'variants') are synthesized. Author (GRA)

N78-23085# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
A NON-STATIONARY MODEL FOR ATMOSPHERIC TURBULENCE PATCHES FOR THE PREDICTION OF AIRCRAFT DESIGN LOADS
R. Noback 19 Nov. 1976 68 p refs
(Contract NIVR-1775)
(NLR-TR-76131-U) Avail: NTIS HC A04/MF A01

A model for atmospheric turbulence is proposed based on the assumption that atmospheric turbulence appears in patches and that within the patches the turbulence can be described as a modulated Gaussian process. Statistical properties of this model and of atmospheric turbulence are compared. Using data from various sources a probability distribution function for patch

lengths is derived, and the relation between patch-intensity and patch length is investigated. Author (ESA)

N78-23086# Royal Aircraft Establishment, Bedford (England). Structures Dept.

A FLIGHT INVESTIGATION OF THE SPANWISE LIFT REQUIREMENTS OF A HELICOPTER ROTOR BLADE

M. J. Riley London Aeron. Res. Council 1978 37 p refs Supersedes RAE-TR-76117; ARC-37080

(ARC-R/M-3812; RAE-TR-76117; ARC-37080) Avail: NTIS HC A03/MF A01; HMSO £4; PHI $15.30

Surface roughness was applied systematically to portions of the leading edge of the blades of a Wessex helicopter to reduce the local value of the maximum lift coefficient. The extent to which the inner portions of the blade could sustain a reduced maximum lift coefficient without reaching limiting control loads was investigated. In this way, some measure of the degree to which reflex camber, with the associated small reduction in maximum lift coefficient, might be used inboard to offset the undesirable pitching moments of high performance sections nearer the blade tip, was obtained. In a similar way, but using local radial bands of roughness in the tip region, those areas of the blade which can provide the largest potential gain from an improved lifting capability have been identified. Author (ESA)

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N78-23087# Air Force Instrument Flight Center, Randolph AFB, Tex.

EVALUATION OF JET 2 INCH STANDBY FLIGHT INSTRUMENT SYSTEM Final Report

James F. Barnette 5 Jan. 1978 19 p

(AD-A051798; USAFIFC-TR-78-1) Avail: NTIS HC A02/MF A01 CSCL 01/4

A pilot factors evaluation of a 2 inch Standby Flight Instrument System has been conducted to determine its acceptability for use in Air Force aircraft. The standby system consists of an attitude indicator, airspeed/Mach indicator, altimeter, and directional gyro indicator. Ten subject pilots selected from USAFIFC personnel and students attending the USAF Instrument Pilot Instructor School participated in the evaluation. Overall subject pilot performance on the 2 inch display was excellent, however, a higher level of effort and concentration was required to obtain desired performance on the display than the subject pilots normally expended on their primary instrument systems. The attitude indicator, airspeed/Mach indicator, and altimeter, are acceptable for installation in US Air Force aircraft with only minor cosmetic changes. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N78-23088*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SUPERSONIC THROUGH-FLOW FAN ENGINES FOR SUPERSONIC CRUISE AIRCRAFT

Leo C. Franciscus Apr. 1978 53 p refs

(NASA-TM-78889; E-9626) Avail: NTIS HC A04/MF A01 CSCL 21E

Engine performance, weight and mission studies were carried out for supersonic through flow fan engine concepts. The mission used was a Mach 2.32 cruise mission. The advantages of supersonic through flow fan engines were evaluated in terms of mission range comparisons between the supersonic through flow fan engines and a more conventional turbofan engine. The specific fuel consumption of the supersonic through flow fan engines was 12 percent lower than the more conventional turbofan. The aircraft mission range was increased by 20 percent with the supersonic fan engines compared to the conventional turbofan. Author

N78-23089*# General Electric Co., Cincinnati, Ohio.

QCSEE TASK 2: ENGINE AND INSTALLATION PRELIMINARY DESIGN Final Report

R. Neitzel, R. Lee, and A. J. Chamay Jun. 1973 350 p refs (Contract NAS3-16726)

(NASA-CR-134738) Avail: NTIS HC A15/MF A01 CSCL 21E

High-bypass turbofan engines with features required for commercial short haul powered lift transports were designed. Two engines were configured for each of the externally blown flap installations, under-the-wing and over-the-wing. Estimates of installed and uninstalled performance, noise, and weight were defined for each propulsion system. Author

N78-23090# Cambridge Univ. (England). Dept. of Engineering.

EXPERIMENTAL STUDY ON BLADE BENDING VIBRATION

T. Matsuura 1977 32 p refs

(CUED/A-Turbo/TR-88; ISSN-0309-6521) Avail: NTIS HC A03/MF A01

Experiments were performed on the forced vibration of cascade blades due to the upstream periodic wakes. The resonance vibration amplitude and phase of the 1st bending mode were measured in a compressor rotor with the h/t ratio of 0.4. Smith's unsteady lift coefficients were used, and the mechanical damping of the blade was introduced to predict the resonance amplitude and phase. Reasonable agreement was seen between the measured results and the prediction. The results show that Smith's theory can well be applied to the prediction of the resonance vibration of the three dimensional cascade blades if the mechanical damping and the vibration mode shape are taken into account. Author

N78-23091# Cambridge Univ. (England). Whittle Lab.

THE MEASUREMENT AND INTERPRETATION OF FLOW WITHIN ROTATING STALL CELLS IN AXIAL COMPRESSORS

I. J. Day and N. A. Cumpsty 1977 58 p refs

(CUED/A-Turbo/TR-90) Avail: NTIS HC A04/MF A01

Detailed measurements have been made with hot wires and fast response pressure transducers in axial compressors operating in rotating stall. Builds with from one to four stages have been studied, as well as a rotor alone build. The degree of reaction was 50% for three different values of design flow coefficient, and in addition a 65% reaction machine was used. From the results it has been possible to describe the flow in stalled compressors. The pattern is very different from that normally assumed, in particular it has been proved that flow is continually entering the cell on one side and leaving on the other. Systematic changes in cell structure with compressor designs have been described and these have been related to the overall properties of the stages, such as pressure ratio and torque. Author

N78-23092# Cambridge Univ. (England). Dept. of Engineering.

A COMPARISON OF EXPERIMENTAL RESULTS AND THREE-DIMENSIONAL THEORETICAL PREDICTIONS FOR A COMPRESSOR ROTOR WITH INLET-DISTORTION, WITH SPECIAL REFERENCE TO STALLING

N. A. Mitchell 1978 44 p

(CUED/A-Turbo/TR-91) Avail: NTIS HC A03/MF A01

This report contains a comparison between the inlet distortion measurements on a low speed axial flow compressor rotor and a three-dimensional inlet distortion analysis of these experiments. The experimental compressor is shown diagrammatically, illustrating how the inlet distortion (a 180 deg square wave stagnation pressure defect) is produced by a wire gauze

upstream of the rotor. The results of these theoretical-experimental comparisons are used to show how the 3-D theory may be used to predict stall regions in inlet distorted axial flow compressors. Author

N78-23093*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMBUSTION OF HYDROGEN IN A TWO-DIMENSIONAL DUCT WITH STEP FUEL INJECTORS
James M. Eggers, Patricia G. Reagon, and Paul B. Gooderum May 1978 56 p refs
(NASA-TP-1159; L-11981) Avail: NTIS HC A04/MF A01 CSCL 21E

An investigation of the combustion of hydrogen perpendicularly injected from step fuel injectors into a Mach 2.72, 2100 K vitiated test gas was conducted. The model simulated the flow between the center and side struts of an integrated scramjet module at Mach 7 flight and an altitude of 29 km. Parametric variation included equivalence ratio, fuel dynamic pressure ratio, and area distribution of the model. The overall area ratio of the model was held constant at 2.87. The data analysis indicated that no measurable improvement in mixing or combustion efficiency was obtained by varying the fuel dynamic pressure ratio from 0.79 to 2.45. Computations indicated approximately 80 percent of the fuel was mixed so that it could react; however, only approximately 50 percent of the mixed fuel actually reacted in two test configurations, and 74 percent in later tests where less area expansion of the flow occurred. Author

N78-23094*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INTERACTION BETWEEN STEP FUEL INJECTORS ON OPPOSITE WALLS IN A SUPERSONIC COMBUSTOR MODEL
Charles R. McClinton May 1978 61 p refs
(NASA-TP-1174; L-11811) Avail: NTIS HC A04/MF A01 CSCL 21E

Results are presented from an experimental investigation of perpendicular, hydrogen fuel injection and combustion from opposing walls in a scramjet combustor model using a longitudinally staged laterally inline step-injection configuration. The model represents a portion of the flow in the Langley integrated modular scramjet engine combustor operating at a flight Mach number of 7. When operating at a ratio of jet pressure to free-stream dynamic pressure of 3, the injectors produce a bulk equivalence ratio of unity. This investigation represents part of a continuing study of the modular engine fuel injectors and is specifically designed to eliminate the adverse lateral pressure gradient observed at the injector location in a previous test. Flow survey contours at three axial locations, ranging from one-third of the engine combustor length to the total engine combustor length, are used to determine mixing efficiency and fuel distribution. Wall static pressures are analyzed by using one-dimensional theory to determine the combustion efficiency. Results show a significant improvement over previous injector designs tested in this duct geometry. Author

N78-23095*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ALTITUDE CALIBRATION OF AN F100, S/N P680063, TURBOFAN ENGINE
Thomas J. Biesiadny, Douglas Lee, and Jose R. Rodriguez May 1978 23 p refs
(NASA-TP-1228; E-9355) Avail: NTIS HC A02/MF A01 CSCL 21E

An airflow and thrust calibration of an F100 engine was conducted in coordination with a flight test program to study airframe-propulsion system integration characteristics of turbofan-powered high-performance aircraft. The tests were conducted with and without augmentation for a variety of simulated flight conditions with emphasis on the transonic regime. Test results for all conditions are presented in terms of corrected airflow and corrected gross thrust as functions of corrected fan speed for nonaugmented power and an augmented thrust ratio as a function of fuel-air ratio for augmented power. Comparisons of measured and predicted data are presented along with the results of an uncertainty analysis for both corrected airflow and gross thrust. Author

N78-23096# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
DEVELOPMENT OF ABRASIVE BLADE TIP COATINGS FOR USE IN AN ABRADABLE TURBINE GAS PATH SEAL SYSTEM Final Report, 1 Jan. - 31 Dec. 1976
Matthew J. Wallace Apr. 1977 70 p refs
(Contract F33615-76-C-5048)
(AD-A051800; FR-8324; AFML-TR-77-47) Avail: NTIS HC A08/MF A01 CSCL 21/5

An abrasive blade tip treatment coating was developed which exhibited promising rub resistance against ceramic (graded ZrO2-Ni Cr) outer air seals. This blade/seal system was designed for advanced high pressure turbine sealing applications. The best tip treatment was produced by vacuum hot pressing a compact comprised of 50 volume percent of coated 8 mil diameter silicon carbide (SiC) grits in a MERL 711 (CoNiCrAlY) alloy matrix. The SiC grits were radio frequency (RF) sputter coated with a 0.1 mil thick aluminum oxide diffusion barrier coating prior to insertion in the matrix. This compact was transient liquid phase bonded to prepared rig and engine blade tips. The abrasive blade tip withstood fabrication, bonding, and heat treatment cycles with little or no grit dissolution and degradation. Blade/seal dynamic rub tests produced little blade tip wear (compared with seal wear) with no dynamic rub impact problems or any loss of abrasive blade tip treatment structural integrity. Author (GRA)

N78-23097# Avco Lycoming Div., Stratford, Conn.
TURBINE TIP-CLEARANCE MEASUREMENT Final Report, Jul. 1975 - Sep. 1977
Steven D. White Dec. 1977 128 p
(Contract DAAJ02-75-C-0051; DA Proj. 1F2-62209-AH-76)
(AD-A052042; LYC-77-46; USARTL-TR-77-47) Avail: NTIS HC A07/MF A01 CSCL 21/5

This report describes the analysis and measurement of turbine tip clearance over the full range of operation of an advanced gas turbine engine. The first-stage turbine of the Lycoming advanced gas generator was used as the test vehicle for analytic and experimental evaluation. Tip-clearance response of the stage was analyzed for steady-state and transient operating conditions through the use of a one-dimensional tip clearance calculation technique. Measurement was accomplished with three laser tip-clearance measurement probes that operate on an optical beam triangulation principle. Comparison of analytic and measured tip-clearance results showed measured clearance to be tighter than predicted over the entire power spectrum. This differential was attributed primarily to a two-dimensional thermal strain distribution in the shroud which had not been accounted for by the analytic technique. Excellent correlation was obtained between the transient tip clearance response characteristics resulting from analysis and measurement. Comparison of measured and predicted component temperatures under steady-state and transient operating conditions verified the accuracy of the thermal analysis procedure. Component distortion, as well as response to transient engine operation, was found to have significant impact on minimum operating tip clearance. Author (GRA)

N78-23098# National Physical Lab., Teddington (England).
NOISE FROM ENGINE THRUST REVERSAL OF LANDING AIRCRAFT
R. F. Higginson and A. J. Rennie Aug. 1977 63 p refs
(NPL-Ac-83) Avail: NTIS HC A04/MF A01

Measurements were made of aircraft noise, with particular reference to the levels of engine thrust reversal noise of different aircraft types at and near to London Airport - Gatwick. The object was to determine the contribution of reverse thrust noise to the total noise exposure at points on the ground. The results show that generally this contribution is small in relation to that of the principal sources of noise, aircraft taking off and climbing out. However, it was found that the noise levels of reverse thrust are sufficient to cause disturbance at times when aircraft landings are the only air traffic movements taking place and the background noise is otherwise low. Author (ESA)

N78-23099# Environmental Protection Agency, Ann Arbor, Mich. Emission Control Technology Div.

AIRCRAFT TECHNOLOGY ASSESSMENT STATUS OF THE GAS TURBINE PROGRAM

Richard Munt and Eugene Danielson Dec. 1976 291 p refs (PB-277351/3; EPA-460/3-76-036) Avail: NTIS HC A13/MF A01 CSCL 21E

Advances that were made in the control of aircraft gas turbine engine emissions are reported. Two technologies of differing complexities evolved. The success of the first, which controls only hydrocarbons and carbon monoxide, is attributable to innovations in engine operation, the fuel injection system, and the airflow patterns within the combustor. The simplicity of the system gives it wide applicability. The second technology, capable of controlling oxides of nitrogen, in addition to HC and CO, uses exotic methods of fuel preparation and multiple zones of combustion. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N78-23100*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

OPTIMAL GUIDANCE AND CONTROL FOR INVESTIGATING AIRCRAFT NOISE-IMPACT REDUCTION

Elwood C. Stewart and Thomas M. Carson May 1978 58 p refs

(NASA-TP-1237; A-7121) Avail: NTIS HC A04/MF A01 CSCL 01C

A methodology for investigating the reduction of community noise impact is reported. This report is concerned with the development of two models to provide data: a guidance generator and an aircraft control generator suitable for various current and advanced types of aircraft. The guidance generator produces the commanded path information from inputs chosen by an operator from a graphic scope display of a land-use map of the terminal area. The guidance generator also produces smoothing at the junctions of straight-line paths.The aircraft control generator determines the optimal set of the available controls such that the aircraft will follow the commanded path. The solutions for the control functions are given and shown to be dependent on the class of aircraft to be considered, that is, whether the thrust vector is rotatable and whether the thrust vector affects the aerodynamic forces. For the class of aircraft possessing a rotatable thrust vector, the solution is redundant; this redundancy is removed by the additional condition that the noise inpact be minimized. Information from both the guidance generator and the aircraft control generator is used by the footprint program to construct the noise footprint. Author

N78-23101# Naval Test Pilot School, Patuxent River, Md.

FIXED WING STABILITY AND CONTROL, THEORY AND FLIGHT TEST TECHNIQUES

S. D. Langdon and W. V. Cross 1 Aug. 1977 661 p refs Revised

(AD-A051864; USNTPS-FTM-103-Rev) Avail: NTIS HC A99/MF A01 CSCL 01/1

This manual is primarily a guide for pilots and engineers attending the U.S. Naval Test Pilot School. However, it may be used as a guide in any fixed wing flying qualities investigation. The text presents basic fixed wing stability and control theory, qualitative and quantitative test and evaluation techniques, and data presentation methods. In most sections, more than one technique is described for each test. Generally, the best technique for a particular investigation will depend on the purpose of the investigation, the amount of instrumentation available and the personal preference of the individual test pilot. The approach of the qualitative stability and control testing presented herein is an attempt to associate all flying qualities tests with particular pilot tasks required in the performance of the total mission of the airplane. The pilot's opinion of a particular flying quality will consequently depend primarily on the pilot workload while performing the desired task. Quantitative evaluation techniques presented may be used to substantiate pilot opinion or gather data for documentation of airplane characteristics. The performance of both qualitative testing and quantitative evaluation is considered essential for any successful flying qualities investigation. Author (GRA)

N78-23102# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INVARIANT AUTOMATIC STABILIZATION SYSTEM OF VERTICAL TAKEOFF AND LANDING AIRCRAFT (VTOL) UNDER STEADY FLIGHT CONDITIONS

R. M. Maresh and V. T. Vigovskiy 19 Oct. 1977 25 p refs Transl. into ENGLISH of the book "Primeneniye Invariantnykh Sistem Avtomaticheskogo Upravleniya" Moscow, Nauka Press, 1970 p 168-176

(AD-A051637; FTD-ID(RS)T-1783-77) Avail: NTIS HC A02/MF A01 CSCL 01/3

The possibility of using lift engines and jet controls in steady flight conditions in order to provide invariance of the coordinates of the VTOL during automatic stabilization of longitudinal movement and different types of disturbing effects was explored. Equations for longitudinal disturbed movement were given in dimensionless form and used to determine an invariant system for longitudinal stabilization during gusts and load discharge. The introduction of an additional signal in the control law of the automatic pilot can provide invariance with respect to both disturbances. A.R.H.

N78-23103# Scientific Systems, Inc., Cambridge, Mass.

GLOBAL STABILITY AND CONTROL ANALYSIS OF AIRCRAFT AT HIGH ANGLES-OF-ATTACK Annual Technical Report, 1 Jun. 1976 - 31 May 1977

Raman K. Mehra, William C. Kessel, and James V. Carroll 30 Jun. 1977 258 p refs

(Contract N00014-76-C-0780)

(AD-A051850; SSI-TR-77-1; ONR-CR215-248-1AR-1) Avail: NTIS HC A12/MF A01 CSCL 01/3

Aircraft dynamic behavior at high angles-of-attack is highly non-linear and, in the past, there has been a lack of suitable techniques for analyzing the global behavior of nonlinear systems. This report describes a new approach based on Bifurcation Analysis and Catastrophe Theory Methodology (BACTM). The approach has been applied to specific jump, hysteresis and limit cycle phenomena such as roll-coupling, pitch-up, wing rock, buffeting, departure and divergence. Three different aircraft have been considered for comparison purposes, and it has been shown how different types of instabilities and families of limit cycles arise as the control variables are varied. A complete representation of the aircraft equilibrium and bifurcation surfaces is given in an eight dimensional space consisting of roll rate, pitch rate, yaw rate, angle-of-attack, sideslip angle, elevator, aileron and rudder deflections. Two dimensional projections of the equilibrium and bifurcation surfaces provide pictorial representations of the aircraft global stability and control behavior at high angles-of-attack. The use of BACTM for spin entry, spin prevention, stability augmentation at high angles-of-attack and nonlinear system identification are also considered. Author (GRA)

N78-23104# Royal Aircraft Establishment, Bedford (England). Structures Dept.

MEASUREMENTS OF CONTROL-SURFACE OSCILLATORY DERIVATIVES ON A SWEPTBACK, TAPERED MODEL WING IN TWO TRANSONIC TUNNELS

N. C. Lambourne, K. C. Wight, and B. L. Welsh London Aeron. Res. Council 1977 54 p refs Supersedes RAE-TR-76007; ARC-36716

(ARC-R/M-3806; RAE-TR-76007; ARC-36716) Avail: NTIS HC A04/MF A01; HMSO £5; PHI $19.20

Results of measurements of control-surface oscillatory derivatives on a sweptback, tapered half-model of a lifting surface of aspect ratio 2 are presented. The measurements were obtained during the development of a derivative rig which measures normal force, pitching moment, wing bending moment, and hinge moment due to control surface oscillation. They were made in the 18 in. X 14 in. (0.46 m X 0.36 m) NPL Teddington tunnel and the 3 ft (0.91 m) RAE Bedford tunnel, the rig being found to operate satisfactorily in both situations. Mach number was varied from 0.4 to 1.0 and stagnation pressure from 0.5 to 2.3 bar.

With this combination of Mach number and stagnation pressure, Reynolds number varied from 1 to 6 million based on mean chord. The effects of varying the control-surface deflection amplitude from 0.4 to 1.6 degrees and the oscillation frequency from 20 to 70 Hz were examined. The effect of tunnel interference was assessed by measurements in ventilated and closed wall working sections in each tunnel. Most of the tests were carried out with transition bands on the model, but a few tests were made with the bands removed. The measured derivatives are compared with those obtained by theoretical methods of calculation. Author (ESA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N78-23105*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

NUMERICAL DESIGN OF STREAMLINED TUNNEL WALLS FOR A TWO-DIMENSIONAL TRANSONIC TEST

Perry A. Newman and E. Clay Anderson (DCW Industries, Inc., Studio City, Calif.) Apr. 1978 24 p refs

(Contract NAS1-14517)

(NASA-TM-78641) Avail: NTIS HC A02/MF A01 CSCL 14B

An analytical procedure is discussed for designing wall shapes for streamlined, nonporous, two-dimensional, transonic wind tunnels. It is based upon currently available 2-D inviscid transonic and boundary layer analysis computer programs. Predicted wall shapes are compared with experimental data obtained from the NASA Langley 6 by 19 inch Transonic Tunnel where the slotted walls were replaced by flexible nonporous walls. Comparisons are presented for the empty tunnel operating at a Mach number of 0.9 and for a supercritical test of an NACA 0012 airfoil at zero lift. Satisfactory agreement is obtained between the analytically and experimentally determined wall shapes. Author

N78-23106*# National Aeronautics and Space Administration, Washington, D. C.

THE FUTURE OF WIND TUNNEL TECHNOLOGY IN GERMANY

Berndt Ewald May 1978 22 p Transl. into ENGLISH of conf. paper from Aero/Thermodynamics Dept., VFW Fokker GmbH, Munich Presented at 9th DGFLE Jahrestagung, Munich, 14-16 Sep. 1976 Original language document was announced as A77-16576

(Contract NASw-2790)

(NASA-TM-75244; Paper-76-170) Avail: NTIS HC A02/MF A01 CSCL 14B

The practical value of a wind tunnel which is not dependent solely on size or achievable Reynolds number was examined. Measurement, interpretative and evaluative procedures developed in small facilities were also studied. Author

N78-23107# Civil and Environmental Engineering Development Office, Tyndall AFB, Fla.

FIRE FIGHTER TOOLS Final Report, 1 Oct. 1976 - 31 Oct. 1977

Norman D. Knowles Jan. 1978 36 p

(AF Proj. 414N)

(AD-A051687; CEEDO-TR-78-2) Avail: NTIS HC A03/MF A01 CSCL 13/12

The Civil and Environmental Engineering Development Office (CEEDO) conducted an evaluation of aircraft crash rescue/fire fighters tools and equipment. This study was necessitated due to the continued growth and development of new tools and the ever increasing numbers of tools being acquired by Air Force Fire Protection Organizations. The purpose of the study was to verify the concepts for fire fighting and rescue operations; to identify the tools and equipment presently carried on fire fighting and rescue vehicles; to determine the usefulness of all inventoried tools and equipment; and to determine a basic selection of tools and equipment that should be carried on fire fighting and rescue vehicles. GRA

N78-23108# General Electric Co., Daytona Beach, Fla.

WIDE-ANGLE, MULTIVIEWER INFINITY DISPLAY DESIGN Final Report, Jul. 1976 - Jul. 1977

L. W. Shaffer and J. A. Waidelich Wright-Patterson AFB, Ohio AFHRL Sep. 1977 117 p refs

(Contract F33615-76-C-0064)

(AD-A051158; AFHRL-TR-77-67) Avail: NTIS HC A06/MF A01 CSCL 14/2

There has long been a need in aircraft simulation for a wide angle visual display that will accommodate the entire crew of a large aircraft type such as a bomber or tanker. This study is concerned with the approach and design of a wide angle display for multiple crew members in large aircraft simulators. The study traces the development of a concept from existing simulation methods. Throughout its 180 by 60 deg field of view which accommodates pilot, copilot, and instructor pilot the final design meets most of the requirements of the original specification. Because of its relatively large optical components the fabrication of the display will be of a developmental nature itself. Author (GRA)

N78-23109# Princeton Univ., N. J. Dept. of Aerospace and Mechanical Sciences.

A HELICOPTER SIMULATOR STUDY OF CONTROL DISPLAY TRADEOFFS IN A DECELERATING APPROACH M.S. Thesis

James Craig Adamson May 1977 81 p refs Sponsored by the Army

(AD-A051242) Avail: NTIS HC A05/MF A01 CSCL 01/3

A total force nonlinear analog model of the UH-1 helicopter was developed which simulates the entire low speed flight envelope from hover to 60 knots. Classical multiloop control theory was applied to design five levels of automatic stabilization which were used as test variables along the control axis of the test matrix. An integrated display was used which superimposes analog symbology over a terrain image. The basic display format, which had been used successfully in flight tests, was modified to provide four levels of display augmentation. These four levels were used as test variables along the display axis of the test matrix. Four helicopter test pilots acted as test subjects and furnished pilot ratings in each cell of the test matrix. In each cell the subject was required to fly the same prescribed flight profile involving a low level decelerating approach to a hover. The data was evaluated based on significant differences among the test cells, and conclusions were drawn concerning the nature of the control and display augmentation most beneficial to the pilot. GRA

N78-23110# McDonnell-Douglas Astronautics Co., St. Louis, Mo.

ELECTROMAGNETIC CHAMBER MODIFICATIONS AND MEASUREMENTS Final Report, Jun. 1976 - Mar. 1977

D. I. Harpring, R. L. Jude, and J. M. Roe 31 Mar. 1978 113 p refs

(Contract N60921-76-C-A273; XF54585001)

(AD-A051222; MDC-E1637; NSWC/DL-TR-3641) Avail: NTIS HC A06/MF A01 CSCL 14/2

Improvements to the MIL-STD-1377(Navy) technique are described. Eight field tuner designs were tested and evaluated and a matched long-wire antenna design is described. Chamber performance, as measured by reduced peak-to-peak variations in transmission loss, was greatly improved at the low end of the frequency band (1-2 GHz). The report recommends that MIL-STD-1377 (Navy) be amended to include the improved tuning schemes and antennas. A sub-task showed that bare wires pick up RF power according to an inverse square of frequency law and that a halfwave dipole approximation is quite good from 100 MHz to 2 GHz. Author (GRA)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N78-23111* National Aeronautics and Space Administration, Washington, D. C.
NASA TO LAUNCH NOAA'S GOES-C EARTH MONITORING SATELLITE
24 May 1978 10 p
(NASA-News-Release-78-72; P68-10077) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22A

NASA's launch of the GOES-C geostationary satellite from Kennedy Space Center, Florida is planned for June 16, 1978. The launch vehicle is a three stage Delta 2914. As its contribution, GOES-C will contribute information from a data sparse area of the world centered in the Indian Ocean. GOES-C will replace GOES-1 and will become GOES-3 once it has successfully orbited at 35,750 kilometers (22,300 miles). NASA's Spaceflight Tracking and Data Network (STDN) will provide support for the mission. Included in the article are: (1) Delta launch vehicle statistics, first, second and third stages; (2) Delta/GOES-C major launch events; (3) Launch operations; (4) Delta/GOES-C personnel.G.Y.

N78-23112*# General Dynamics/Convair, San Diego, Calif.
SPACE CONSTRUCTION AUTOMATED FABRICATION EXPERIMENT DEFINITION STUDY (SCAFEDS), PART 2 Final Briefing
3 Feb. 1978 136 p
(Contract NAS9-15310)
(NASA-CR-151705; CASD-ASP-77-016-Pt-2) Avail: NTIS HC A07/MF A01 CSCL 22A

The techniques, processes, and equipment required for automatic fabrication and assembly of structural elements in using Shuttle as a launch vehicle, and construction were defined. Additional construction systems operational techniques, processes, and equipment which can be developed and demonstrated in the same program to provide further risk reduction benefits to future large space systems were identified and examined. Author

N78-23113*# National Aeronautics and Space Administration, Washington, D. C.
OAST SPACE SYSTEMS STUDIES REVIEW MEETING
Stanley R. Sadin Jul. 1977 496 p Meeting held at Washington, D. C., 1-2 Jun. 1977
(NASA-TM-79447) Avail: NTIS HC A21/MF A01 CSCL 22A

The agenda of a meeting studying the overall objectives of the space studies program is presented. A review of studies in: (1) advanced automation needs analysis; (2) applications technology planning; (3) technology enablement, space power systems; (4) VOIR/SEASAT follow on technology readiness; (5) surface exploration, prospecting, and assaying; and (6) spaceborne antenna and microwave systems technology study is included. Advanced space transportation technology studies and the multipurpose space service platform study were examined, as well as the lunar materials for space contribution. Author

N78-23114*# National Aeronautics and Space Administration, Washington, D. C.
OAST SPACE SYSTEMS STUDIES REVIEW MEETING
Stanley R. Sadin 1978 415 p Meeting held at Washington, D. C., 11-12 Jan. 1978
(NASA-TM-79446) Avail: NTIS HC A18/MF A01 CSCL 22A

The agenda from the OAST review meeting is presented. Some of the following topics were reviewed in detail: (1) space utilization; (2) space transportation and (3) science and exploration. B.B.

N78-23115*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE PROCESSING APPLICATIONS BIBLIOGRAPHY
Apr. 1978 180 p
(NASA-TM-78167) Avail: NTIS HC A09/MF A01 CSCL 22A

This special bibliography lists 724 articles, papers, and reports which discuss various aspects of the use of the space environment for materials science research or for commercial enterprise. The potentialities of space processing and the improved materials processes that are made possible by the unique aspects of the space environment are emphasized. References identified in April, 1978 are cited. Author

N78-23116*# Rensselaer Polytechnic Inst., Troy, N. Y.
GROWTH OF SINGLE CRYSTALS BY VAPOR TRANSPORT IN ZERO-GRAVITY ENVIRONMENT, GROUND-BASED EXPERIMENTS Summary Report, Apr. 1977 - Mar. 1978
Heribert Wiedemeier Apr. 1978 11 p
(Contract NAS8-26146)
(NASA-CR-150680) Avail: NTIS HC A02/MF A01 CSCL 20B

Mass and heat transfer phenomena associated with the growth of single crystals by chemical vapor transport reactions were investigated. In this technique, a gaseous transport agent reacts with the solid source material to form exclusively gaseous products. The gas phase species migrate from the source to the condensation zone of the closed reaction ampoule where the reverse reaction occurs with formation of single crystals. The necessary concentration gradient is achieved by means of a temperature gradient. Author

N78-23117*# Marvex Corp., Saratoga, Calif.
NASA/ESA CV-990 SPACELAB SIMULATION (ASSESS 2) Final Report
D. R. Mulholland, G. M. Androes, and J. F. Reeves Jan. 1978 198 p refs
(Contract NAS2-9514)
(NASA-CR-152122) Avail: NTIS HC A09/MF A01 CSCL 22A

To test the validity of the ARC approach to Spacelab, several missions simulating aspects of Spacelab operations have been conducted as part of the ASSESS Program. Each mission was designed to evaluate potential Shuttle/Spacelab concepts in increasing detail. For this mission, emphasis was placed on development and exercise of management techniques planned for Spacelab using management participants from NASA and ESA who have responsibilities for Spacelab 1 which will be launched in 1980. Author

N78-23118# Royal Norwegian Council for Scientific and Industrial Research, Oslo.
SPACE ACTIVITY IN NORWAY Annual Report 1976
Jun. 1977 34 p refs Presented at the 20th COSPAR Plenary Meeting and Assoc. Activities, Tel Aviv, Israel, 13-18 Jun. 1977
(SAD-65-T) Avail: NTIS HC A03/MF A01

The scientific program, application program, and other space activities related to satellite geodesy, earth resources, etc., for 1976 in Norway are presented as well as activities planned for 1977, and beyond 1977. ESA

N78-23119# European Space Research and Technology Center, Noordwijk (Netherlands). Product Assurance Div.
QUALIFICATION OF MATERIALS AND MATERIALS LISTS APPLICABLE TO SPACE PROJECTS
Jan. 1978 19 p Supersedes ESA-PSS-19/QRM-16-Issue-2, Sep. 1975; see N78-10203
(ESA-PSS-19/QRM-16-Issue-2) Avail: NTIS HC A02/MF A01

The documentation system that must be applied to materials during the initial phases of any space project is specified. The documentation considered here consists of (1) a preferred materials lists and (2) a declared materials lists. Only those mentioned under (2) are a requirement imposed by ESA on its contractors. Preferred materials lists, which contractors should establish to facilitate adherence to this requirement, are also dealt with. An interpretation of the term qualification is given. Author (ESA)

N78-23120# Centre National de la Recherche Scientifique, Orleans (France). Centre de Recherches sur la Physique des Hautes Temperatures.
DEVELOPMENT OF A FURNACE FOR SPACELAB (2000 C IN OXIDIZING ATMOSPHERE) [REALISATION D'UN FOUR POUR SPACELAB (2000 C EN ATMOSPHERE OXYDANTE)]
Paris ESA Sep. 1977 101 p In FRENCH

(Contract ESTEC-2788/76-F-WMT(SC))
(ESA-CR(P)-1033) Avail: NTIS HC A06/MF A01

Results are reported of a study on a universal space furnace for Spacelab, which has a zirconium-based heating module and a flexible enclosure satisfying the requirements of a high temperature gradient furnace such as an isothermal furnace or a multiple gradient furnace controllable between 0 and 250 C/cm. Two types of gradient furnaces were developed according to these principles, having a rationalized enclosure with regard to space, dissipated energy, weight, and observability of the furnace's heart. ESA

N78-23121# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON EASTERN EUROPE: SCIENTIFIC AFFAIRS, NO. 581
5 May 1978 48 p Transl. into ENGLISH from various Czechoslovakian and Hungarian journals
(JPRS-71066) Avail: NTIS HC A03/MF A01

International cooperation in space programs are reported including Czechoslovakian collaboration in the Intercosmos program, and the training of Hungarian astronauts in the Soviet Union. For individual titles, see N78-23122 through N78-23124.

N78-23122# Joint Publications Research Service, Arlington, Va.
CSSR CONTRIBUTION TO SPACE RESEARCH: CSSR EXPERIMENTS ON SALYUT 6
Vaclav Bumba *In its* Transl. on Eastern Europe: Sci. Affairs, No. 581 (JPRS-71066) 5 May 1978 p 1-6 Transl. into ENGLISH from Rude Pravo (Prague), 4 Mar. 1978 p 3 (For availability see N78-23121 14-12)
Avail: NTIS HC A03/MF A01

Czechoslovakian technology used during Salyut-6 experiments included an electric dynamic katathermometer for measuring skin temperature to determine how effectively the cosmonaut's body expended heat in a weightless state, in an environment lacking natural air circulation. A tissue oximeter was also developed to measure the effects of long term weightlessness on the oxygen supply of tissue. Other experiments described are: (1) a psychological study of the structure and dynamics of the cosmonaut's actual mental states in the course of flight preparation, during flight, and after flight completion, (2) a visual experiment designed to determine the altitude and number of dust strata primarily of meteoritic origin in the upper atmosphere; (3) the solidification of the eutectic state of the silver-lead chloride and the copper-lead chloride systems; and (4) a joint Soviet-Czechoslovak experiment to determine the effect of weightlessness on the population increase of unicellular green algae of the chlorella family and of some related families. A.R.H.

N78-23123# Joint Publications Research Service, Arlington, Va.
CONTRIBUTION TO COSMIC RESEARCH DISCUSSED: INTERKOSMOS SECRETARY'S EVALUATION
Vaclav Bumba *In its* Transl. on Eastern Europe: Sci. Affairs, No. 581 (JPRS-71066) 5 May 1978 p 8-16 refs Transl. into ENGLISH from Tvorba (Prague), no. 7, 15 Feb. 1978 p 11 (For availability see N78-23121 14-12)
Avail: NTIS HC A03/MF A01

With the formation of the Czechoslovakian Intercosmos commission in 1967, programs were developed in space physics, space meteorology, spacecraft communications, and aerospace medicine and exobiology. Working groups from that country have participated in all 17 Intercosmos satellites, in the launching of six Vertikal rockets, and in the development of the laser radio for precise tracking of satellite position. Biological experiments carried on Kosmos 690, 782, and 936 satellites are described. Statistical processing of satellite photographs of cloud cover is being used to investigate the shape of atmospheric fronts and factors influencing their development as well as in improving weather reports. Developments in satellite television broadcasting are reported as well as the development of telecommunication links, and the use of satellite observations in geology, geophysics, and geography. A.R.H.

N78-23124# Joint Publications Research Service, Arlington, Va.
SELECTION, TRAINING OF HUNGARIAN ASTRONAUTS
Laszlo Szabo *In its* Transl. on Eastern Europe: Sci. Affairs, No. 581 (JPRS-71066) 5 May 1978 p 19-23 Transl. into ENGLISH from Nepszabadsag (Budapest), 22 Mar. 1978 p 5 (For availability see N78-23121 14-12)
Avail: NTIS HC A03/MF A01

More than one hundred people participated in the selection and domestic preparation of the two Hungarian astronaut candidates accepted for training at the Gagarian Center in the Soviet Union where a perfect command of the Russian language is a basic requirement. Special emphasis was placed on evaluating the candidate's tolerance of weightlessness. Eye and response time measurements were conducted in a large barometric chamber. Personality and intelligence tests were also given. A.R.H.

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N78-23125# Indian Space Research Organization, Bangalore. Satellite Centre.
ORBIT SELECTION FOR EARTH RESOURCES SATELLITES
C. K. Raja Singh and P. S. Goel Jan. 1977 14 p refs
(ISRO-ISAC-TN-05-77) Avail: NTIS HC A02/MF A01

Orbit parameters for earth resources satellites were determined. A proper choice of the orbit parameters is essential so as to reap better results from the mission. The basic concepts of satellite orbits, such as the elements of orbit and effects of the asphericity of the earth on orbital elements were explained. Expressions for calculating the orbit period, orbit regression, apseline rotation were given. The factors affecting the life of the orbit are discussed. The relationship between orbit life time versus altitude for Aryabhata and Rohini type of satellite configuration was also included. Various types of orbits such as sun synchronous, recursive, repetitive coverage were examined. The requirements of different payloads and their influence on the selection of orbit are summarized. The equations describing sun synchronism and ground trace were stated. Using these equations design charts relating the various parameters for different cases were drawn. Use of the charts was illustrated with a few examples. Author

N78-23126# Royal Aircraft Establishment, Farnborough (England).
SATELLITE ORBIT AND ATTITUDE THEORY AND ITS USE WITH SKYNET 2
R. H. Merson Jun. 1977 136 p refs
(RAE-TR-77083; BR59516) Avail: NTIS HC A07/MF A01

An introduction to satellite orbit and attitude theory, suitable for use with a geostationary (synchronous) satellite is made. The basic Keplerian orbit is derived, first order approximations to luni-solar and geopotential perturbations are developed and methods of orbit computation described. Also discussed are longitudinal drift, the technique of orbit maneuvers, and attitude determination and control. Throughout the paper the principles are illustrated by reference to the Skynet satellites and a summary of computer programs in the Skynet 2 suite is given. Author (ESA)

N78-23127# Royal Aircraft Establishment, Farnborough (England).
METHODS FOR PREDICTING SATELLITE ORBITAL LIFETIMES
D. G. King-Hele Jul. 1977 55 p refs
(RAE-TR-77111; BR59173) Avail: NTIS HC A04/MF A01

The accurate prediction of satellite decay dates some months or years ahead remains one of the most difficult and intractable problems of orbital mechanics, chiefly because the lifetime depends strongly on the future variations in air density, which are at present not accurately predictable. Simple graphical methods are presented for estimating the future lifetime of an earth satellite from its current rate of decay, using theory adapted

to an atmosphere with a realistic variation of density with height. The effects of the temperature of the earth and atmosphere from spherical symmetry, and the variation of density with time, are approximated by specifying correction factors. Orbits which experience serious lunisolar perturbations call for numerical-integration methods, and the uses of the computer programs PROD and PTDEC are described. Despite the many uncertainties, the remaining lifetimes of most satellites should be predictable with an accuracy of plus or minus 10% by these methods, which are based on many years' experience in making the monthly decay predictions for the RAE table of satellites. Author (ESA)

N78-23128# European Space Agency, Paris (France).
ORBIT DETERMINATION AND ORBIT PREDICTION FROM MEASURED DATA USING THE ELKORR PROGRAM. A REPORT ON THE METHOD AND EXPERIENCE IN USING IT
K. Zimmermann Mar. 1978 97 p refs Transl. into ENGLISH of 'Bahnbestimmung u. -vorhersage aus Messdaten mit dem Programm ELKORR. Verfahrens- u. Erfahrungsber.', DFVLR, Oberpfaffenhofen, West Ger. Report DLR-IB-552-76/10, 12 Aug. 1977 Original report in GERMAN previously announced as N78-18094
(ESA-TT-447; DLR-IB-552-76/10) Avail: NTIS HC A05/MF A01

Satellite orbit determination based on the Differential Orbit Improvement (DOI) procedure is discussed. The DOI technique is reduced to minimization of the quadratic loss function. The relation between the quadratic loss function and the required expectation value and the observational covariance matrix is derived. Thus a comparison between the DOI and the Extended Kalman Filter theory can be made. The relation between the information matrix and the covariance matrix is dealt with. The procedure used in ELKORR to change and update measured data sets is derived. The procedure for solving the system and measured data equations as well as the required variance calculation are presented schematically. Application results to near earth and geostationary satellites are given and data processing and program organization aspects are treated. ESA

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N78-24038# Joint Publications Research Service, Arlington, Va.
ROCKET LAUNCHING FACILITIES AT BAYKONUR DESCRIBED
B. P. Vladimirov *In its* Transl. on USSR Sci. and Technol. (JPRS-71181) 25 May 1978 p 41-53 Transl. into ENGLISH from Zemlya i Vselennaya (Moscow), no. 1, 1978 p 64-71
(For availability see N78-24033 14-99)
Copyright. Avail: Issuing Activity

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N78-23129*# Public Service Satellite Consortium, Denver, Colo. Dept. of Engineering.
TECHNICAL ASSESSMENT OF PSSC-SUPPORTED EXPERIMENTS AND DEMONSTRATIONS Final Report, Oct. 1977 - Mar. 1978
Apr. 1978 50 p
(Contract NAS5-24284)
(NASA-CR-156751) Avail: NTIS HC A03/MF A01 CSCL 22A

A description of CTS and ATS short-term and long-term satellite demonstration supported through usage of a satellite communication ground station complex is presented. User assessments about the programmatic impact of their demonstrations and experiments were summarized. The technical planning and coordination process involved in satellite utilization is also presented. Author

N78-23130# Indian Space Research Organization, Bangalore. Satellite Centre.
MAGNETIC ATTITUDE CONTROL OF NEAR EARTH SPINNING SATELLITES
S. Rajaram and P. S. Goel Jan. 1977 15 p refs
(ISRO-ISAC-TN-04-77) Avail: NTIS HC A02/MF A01

Magnetic attitude control systems were employed in several satellite programs due to their salient features like simplicity in construction, absence of moving parts, less power and space requirements and less weight. A control law suitable for keeping the spin axis of the satellite perpendicular to the plane of a near circular orbit was derived, and a control scheme incorporating the control law is described. The control law was developed from fundamental gyroscopic principles. It was seen that the polarity of the dipole moment of the magnetorquer operated in a bang-bang pattern has to be changed four times in an orbit but not at the intervals of quarter orbit. The use of magnetic torquer to overcome the effect of orbital regression on spin axis attitude was also explained. The control law can be realized by using horizon sensors for attitude error measurements and magnetorquers to produce torque. Details about the control law were given. The dipole moments of torquers for control of RS type of satellites were calculated. Author

N78-23131# Indian Space Research Organization, Bangalore. Satellite Centre.
PASSIVE NUTATION DAMPERS FOR SPINNING SATELLITES
N. K. Malik and P. S. Goel Jan. 1977 36 p refs
(ISRO-ISAC-TN-06-77) Avail: NTIS HC A03/MF A01

The coning motion of an inherently stable spinning satellite can be dampened out by passive mechanism, where the energy dissipation takes place due to the friction between the two relatively moving bodies. A theoretical investigation of the damping of the precession of an axis-symmetric spinning satellite using such a nutation damper located arbitrarily in the satellite was conducted. Starting with the Lagrange's equations, the motion of the damper components as a function of satellite parameters like spin rate and moment of inertia were derived. In the analysis, various simplifying assumptions were made e.g., the basis sinusoidal nature of the satellite transverse velocities are not affected by the damper element motion. The energy dissipation rate, the stability of the damper motion, the residual coning angle and the tuning conditions were derived for spring dashpot, pendulum, ball in tube and fluid-in-tube-dampers in various mounting configurations. The energy loss in the spring dashpot damper takes place due to the hydraulic friction between the fluid and the dashpot. Similarly, in the pendulum damper it is either in viscoelastic pivot or in ball-bearing and viscous fluid. Ball-in-tube damper works on the static and viscous friction between the ball and the tube. Author

N78-23132# European Space Research and Technology Center, Noordwijk (Netherlands).
DEVELOPMENT AND IN-FLIGHT PERFORMANCE OF THE COS-B THERMAL CONTROL SYSTEM
C. Alfermann Paris ESA Jan. 1978 77 p
(ESA-STM-202) Avail: NTIS HC A05/MF A01

The development and implementation of the Cos-B thermal-control subsystem are described and in-flight performances during the first 17 months in orbit are compared with pre-launch predictions. The overall satellite system, requirements, and constraints are discussed, together with a detailed description of the thermal layout and a summary of the results of surface-property measurements. The main steps of the development sequence are presented, and the importance is stressed of the solar simulation test, which revealed major deficiencies of the thermal layout, mainly attributable to the unfavorable location

of the shunt assembly. Analytical activities are explained, including those problem areas that led to the introduction of a software system to support active in-orbit temperature control of the thermally passive satellite via operational modes and attitude maneuvers. The in-flight temperature performances under various orbital heating conditions are demonstrated and compared with pre-launch predictions. Author (ESA)

N78-23133# Societe Nationale Industrielle Aerospatiale, Cannes (France). Div. Systemes Balistiques et Spatiaux.
THERMAL TESTING OF LARGE SPACECRAFT. APPLICATIONS TO THE ARIANE PAYLOAD Final Report [ESSAIS THERMIQUES SUR LES OBJETS SPATIAUX DE GRANDES DIMENSIONS. APPLICATIONS A LA CHARGE UTILE D'ARIANE]
Girard and Ziliani Paris ESA 10 Jan. 1978 107 p refs In FRENCH
(Contract ESTEC-3224/NL/77-HP(SC))
(Rept-817-CA/44; ESA-CR(P)-1042) Avail: NTIS HC A06/MF A01

A study was carried out to determine the requirements on thermal test facilities in view of the development of large satellites foreseen in the period 1980 to 1990, in particular the H-SAT (Phebus-X). The general thermal test philosophy is outlined, and existing European test facilities are reviewed. The effect of limitations in existing test facilities on the quality of H-SAT thermal tests is discussed. The upper mass and dimensional limits imposed by existing facilities to obtain satisfactory results from satellite thermal tests are defined. Possibilities of exceeding these limits either by modification of the satellite or by modification of the facilities were investigated. ESA

N78-23134# Royal Aircraft Establishment, Farnborough (England).
PERFORMANCE OF THE 100 ELEMENT ALBEDO SENSOR EXPERIMENT ON THE SATELLITE MIRANDA (X4)
J. I. Thomas Jul. 1977 26 p refs
(RAE-TR-77102; BR59522) Avail: NTIS HC A03/MF A01

The 100 element albedo sensor as installed in the Miranda satellite is described and the results obtained analyzed. The brightness variation of the earth in the region of the terminator is determined. The results also show that the sensor could be used to measure attitude to an accuracy of about 0.1 deg.
Author (ESA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N78-23135*# IBM Federal Systems Div., Houston, Texas.
SELECTION OF SHUTTLE PAYLOAD DATA PROCESSING DRIVERS FOR THE DATA SYSTEM NEW TECHNOLOGY STUDY
10 Aug. 1976 230 p refs
(Contract NAS9-14350)
(NASA-CR-14350) Avail: NTIS HC A11/MF A01 CSCL 22B

An investigation of all payloads in the IBM disciplines and the selection of driver payloads within each discipline are described. The driver payloads were selected on the basis of their data processing requirements. These requirements are measured by a weighting scheme. The total requirements for each discipline are estimated by use of the technology payload model. The driver selection process which was both a payload by payload comparison and a comparison of expected groupings of payloads was examined. Author

N78-23136*# Martin Marietta Aerospace, Denver, Colo.
PAYLOAD TRANSPORTATION SYSTEM STUDY Final Report
Aug. 1976 202 p refs
(Contract NAS10-8902)
(NASA-CR-157007) Avail: NTIS HC A10/MF A01 CSCL 22A

A standard size set of shuttle payload transportation equipment was defined that will substantially reduce the cost of payload transportation and accommodate a wide range of payloads with minimum impact on payload design. The system was designed to accommodate payload shipments between the level 4 payload integration sites and the launch site during the calendar years 1979-1982. In addition to defining transportation multi-use mission support equipment (T-MMSE) the mode of travel, prime movers, and ancillary equipment required in the transportation process were also considered. Consistent with the STS goals of low cost and the use of standardized interfaces, the transportation system was designed to commercial grade standards and uses the payload flight mounting interfaces for transportation. The technical, cost, and programmatic data required to permit selection of a baseline system of MMSE for intersite movement of shuttle payloads were developed. Author

N78-23137# European Space Agency, Paris (France).
THE MAIN PROPULSION SYSTEM OF THE US SPACE SHUTTLE. AN EXAMPLE OF THE PERFORMANCE INCREASE OF PROPULSION SYSTEMS OF SINGLE STAGE LAUNCH ROCKETS
Robert H. Schmucker Feb. 1978 39 p refs Transl. into ENGLISH of 'Das Haupttriebwerk des US-Raumtransporters - Ein Beispiel fuer die Leistungssteigerung bei Triebwerken einstufiger Traegerraketen', DFVLR, Hardthausen, West Ger. Report DLR-IB-76/3, 1976 Original report in GERMAN previously announced as N78-18110
(ESA-TT-461; DLR-IB-76/3) Avail: NTIS HC A03/MF A01

The U.S. Space Shuttle Main Engine (SSME) is discussed. Single stage launch vehicles with low payload in comparison to the takeoff mass are very sensitive to the specific impulse performance of the propulsion engine, which should therefore be maximized. The average available impulse depends on the mixing behavior of the propellant combination, on the combustion chamber pressure, surface ratio, propellant supply system, and nature of the ascent orbit, and on losses in the combustion chamber and in the expansion nozzle. The various criteria for the design of single stage launch vehicles are given and the nozzle geometry requirements are presented. The technical implementation is exemplified with the SSME, of which the main construction demands and data are given. Using available experimental values of existing propulsion systems, a critical evaluation of the performance increase that can be obtained by using high pressure technology was made. ESA

N78-23138# European Space Agency, Paris (France).
SEAP: A SPACELAB EXPERIMENTAL PROPULSION PLATFORM FOR TRANSPORTING SPACELAB PAYLOADS. FIRST STUDY RESULTS
T. Lange, D. Manski, R. Naehle, M. Piening, S. G. Rosen, H. P. Schmidt, and G. S. Shau Apr. 1978 90 p refs Transl. into ENGLISH of 'SEAP: Eine Spacelab-Experimenten-Antriebsplattform fuer den Transport von Spacelab Nutzmassen', DFVLR, Lampoldshusen, West Ger. Report DLR-IB-456-76/1, Jan. 1976 Original report in GERMAN previously announced as N78-18109
(ESA-TT-460; DLR-456-76/1) Avail: NTIS HC A05/MF A01

The possibility of using a propulsive platform for the transport of Spacelab payloads was investigated. Topics which were dealt with include system analytical considerations on the concept of a Spacelab-Experimenten-Antriebsplattform (SEAP - Spacelab Experiments Propulsive Platform), and a description, and an analysis of the SEAP subsystems, such as the propulsive system, orbits and performance attitude control, energy housekeeping, and power supply. ESA

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N78-23139*# Howard Univ., Washington, D. C. Dept. of Mechanical Engineering.

THE DYNAMICS AND CONTROL OF LARGE FLEXIBLE SPACE STRUCTURES. PART A: DISCRETE MODEL AND MODAL CONTROL Final Report

Peter M. Bainum and R. Sellappan May 1978 59 p refs (Grant NsG-1414)

(NASA-CR-156975) Avail: NTIS HC A04/MF A01 CSCL 22B

Attitude control techniques for the pointing and stabilization of very large, inherently flexible spacecraft systems were investigated. The attitude dynamics and control of a long, homogeneous flexible beam whose center of mass is assumed to follow a circular orbit was analyzed. First order effects of gravity gradient were included. A mathematical model which describes the system rotations and deflections within the orbital plane was developed by treating the beam as a number of discretized mass particles connected by massless, elastic structural elements. The uncontrolled dynamics of the system are simulated and, in addition, the effects of the control devices were considered. The concept of distributed modal control, which provides a means for controlling a system mode independently of all other modes, was examined. The effect of varying the number of modes in the model as well as the number and location of the control devices were also considered. Author

N78-23140*# Howard Univ., Washington, D. C. Dept. of Mechanical Engineering.

THE DYNAMICS AND CONTROL OF LARGE FLEXIBLE SPACE STRUCTURES. PART B: DEVELOPMENT OF CONTINUUM MODEL AND COMPUTER SIMULATION Final Report

Peter M. Bainum, V. K. Kumar, and Paul K. James May 1978 116 p refs (Grant NsG-1414)

(NASA-CR-156976) Avail: NTIS HC A06/MF A01 CSCL 22B

The equations of motion of an arbitrary flexible body in orbit were derived. The model includes the effects of gravity with all its higher harmonics. As a specific example, the motion of a long, slender, uniform beam in circular orbit was modelled. The example considers both the inplane and three dimensional motion of the beam in orbit. In the case of planar motion with only flexible vibrations, the pitch motion is not influenced by the elastic motion of the beam. For large values of the square of the ratio of the structural modal frequency to the orbital angular rate the elastic motion was decoupled from the pitch motion. However, for small values of the ratio and small amplitude pitch motion, the elastic motion was governed by a Hill's 3 term equation. Numerical simulation of the equation indicates the possibilities of instability for very low values of the square of the ratio of the modal frequency to the orbit angular rate. Also numerical simulations of the first order nonlinear equations of motion for a long flexible beam in orbit were performed. The effect of varying the initial conditions and the number of modes was demonstrated. Author

N78-23141*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ACTIVE NUTATION CONTROLLER Patent Application

Henry C. Hoffman and James H. Donohue, inventors (to NASA) Filed 19 Apr. 1978 30 p

(NASA-Case-GSC-12273-1; US-Patent-Appl-SN-897830) Avail: NTIS HC A03/MF A01 CSCL 22B

An apparatus for controlling nutation motion in a spinning body is described. Features of the apparatus include an angular accelerometer with its input axis perpendicular to the spin axis of the body, a flywheel with an axis of rotation perpendicular to the axis of the accelerometer and to the spin axis of the body, and a motor for driving the flywheel to attenuate or build nutation. The motor is controlled by circuitry that monitors the output of the angular accelerometer and drives the motor clockwise or counterclockwise during predetermined nutation angles synchronized to the zero crossover points of the accelerometer signal and centered about the nutation peaks. The use of an angular accelerometer rather than a linear accelerometer or gyro to monitor nutation enables placement of the nutation control apparatus at any location relative to the spin axis of the body requiring only crude orientation and no calibration. NASA

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N78-23142*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A MECHANICAL, THERMAL AND ELECTRICAL PACKAGING DESIGN FOR A PROTOTYPE POWER MANAGEMENT AND CONTROL SYSTEM FOR THE 30 cm MERCURY ION THRUSTER

G. Richard Sharp, Louis Gedeon, Jon C. Oglebay, Francis S. Shaker, and Clifford E. Siegert 1978 31 p refs Presented at the 13th Intern. Elec. Propulsion Conf., San Diego, Calif., 25-27 Apr. 1978; sponsored by AIAA and DGLR

(NASA-TM-78862; E-9593) Avail: NTIS HC A03/MF A01 CSCL 21C

A prototype electric power management and thruster control system for a 30 cm ion thruster is described. The system meets all of the requirements necessary to operate a thruster in a fully automatic mode. Power input to the system can vary over a full two to one dynamic range (200 to 400 V) for the solar array or other power source. The power management and control system is designed to protect the thruster, the flight system and itself from arcs and is fully compatible with standard spacecraft electronics. The system is easily integrated into flight systems which can operate over a thermal environment ranging from 0.3 to 5 AU. The complete power management and control

system measures 45.7 cm (18 in.) x 15.2 cm (6 in.) x 114.8 cm (45.2 in.) and weighs 36.2 kg (79.7 lb). At full power the overall efficiency of the system is estimated to be 87.4 percent. Three systems are currently being built and a full schedule of environmental and electrical testing is planned. Author

N78-23143*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A 30-cm MERCURY ION THRUSTER PERFORMANCE WITH A 1 kW CAPACITOR-DIODE VOLTAGE MULTIPLIER BEAM SUPPLY
F. F. Terdan and W. T. Harrigill, Jr. 27 Apr. 1978 17 p refs Presented at the 13th Intern. Elec. Propulsion Conf., San Diego, Calif., 25-27 Apr. 1978; sponsored by AIAA and DGLR
(NASA-TM-78864; E-9595; AIAA-Paper-78-686) Avail: NTIS HC A02/MF A01 CSCL 21C

A 1 kW solar array and capacitor-diode voltage multiplier converter (S/A-CDVM) was successfully integrated with a 30 cm diameter mercury ion thruster system to provide ion beam power. Measurements were made to compare steady state and transient response performance of a conventional bridge converter with the S/A-CDVM converter used for the ion beam supply. The ability to recover from screen to accelerator arcs and promptly re-establish stable thruster performance was demonstrated. Solar array transient response to thruster arcing was measured. Author

N78-23144*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SENSITIVITY OF 30-cm MERCURY BOMBARDMENT ION THRUSTER CHARACTERISTICS TO ACCELERATOR GRID DESIGN
V. K. Rawlin 1978 29 p refs Presented at the 13th Intern. Elec. Propulsion Conf., San Diego, Calif., 25-27 Apr. 1978; sponsored by AIAA and DGLR
(NASA-TM-78861; E-9591; AIAA-Paper-78-668) Avail: NTIS HC A03/MF A01 CSCL 21C

The design of ion optics for bombardment thrusters strongly influences overall performance and lifetime. The operation of a 30 cm thruster with accelerator grid open area fractions ranging from 43 to 24 percent, was evaluated and compared with experimental and theoretical results. Ion optics properties measured included the beam current extraction capability, the minimum accelerator grid voltage to prevent backstreaming, ion beamlet diameter as a function of radial position on the grid and accelerator grid hole diameter, and the high energy, high angle ion beam edge location. Discharge chamber properties evaluated were propellant utilization efficiency, minimum discharge power per beam amp, and minimum discharge voltage. Author

N78-23145# European Space Agency, Paris (France).
USE OF FLUID INJECTION TO REGULATE THE COMBUSTION CHAMBER PRESSURE FOR UNSTABLY BURNING SOLID PROPELLANT COMBUSTION
Robert H. Schmucker and Hendrik R. Lips Feb. 1978 17 p refs Transl. into ENGLISH of 'Brennkammerdruckregelung eines instabil brennenden Festtreibstoffes durch Flossigkeitseinspritzung', DFVLR, Lampoldshausen, West Ger. Report DLR-IB-456-77/4, Jul. 1977 Original report in GERMAN previously announced as N78-18124
(ESA-TT-457; DLR-IB-456-77/4) Avail: NTIS HC A02/MF A01

Solid propellants having a pressure exponent greater than 1 cannot be used in a rocket engine without additional modifications. Liquid injection represents a method to stabilize the combustion. The relationships between the operating point, stability, and the operation are derived. The stability limit for quasi-steady operation was investigated, and the influence of dynamic effects on the combustion pressure characteristics presented. Author (ESA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N78-23146 Arizona Univ., Tucson.
USE OF THE INDUCTIVELY-COUPLED PLASMA FOR THE ELEMENTAL ANALYSIS OF ORGANIC COMPOUNDS Ph.D. Thesis
David Lee Windsor 1977 313 p
Avail: Univ. Microfilms Order No. 78-05673

The feasibility of using inductively coupled plasmas optical emission spectroscopy for the simultaneous multielement analysis of organic compounds was investigated, with emphasis on the elemental composition of each effluent from a gas chromatograph. The accuracy of the method allows the determination of empirical formulas, and in conjunction with retention time data, molecular formulas. An improved plasma torch was developed which facilitates the analysis of organic compounds. To perform simultaneous multielement analyses, the optical system included a direct reader interfaced to a mini-computer. A CONVERS operating system was written for the computer. This operating system simplifies the development of software for the control of the computer interface and for data acquisition. Dissert. Abstr.

N78-23147# National Bureau of Standards, Washington, D. C. Office of Standard Reference Materials.
STANDARD REFERENCE MATERIALS: GUIDE TO UNITED STATES REFERENCE MATERIALS
J. Paul Cali and Thomas Plebanski (Polish Comm. of Standardization and Measures) Feb. 1978 57 p refs
(PB-277173/1; NBS-SP-260-57; LC-77-28819) Avail: NTIS HC A04/MF A01 CSCL 07D

A list of reference materials produced and distributed by U.S. manufacturers, both public and private is summarized. Extensive tables were indexed by use to which reference materials may be put. Properties covered include: chemical composition (high purity), physical properties, engineering and technological properties, and biochemical properties. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N78-23148*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
SIGNATURE ANALYSIS OF ACOUSTIC EMISSIONS FROM COMPOSITES Final Report, 1 Oct. 1975 - 30 Mar. 1978
Edmund G. Henneke, II 19 May 1978 79 p refs
(Grant NsG-1238)
(NASA-CR-145373) Avail: NTIS HC A05/MF A01 CSCL 11D

Acoustic emission data were obtained from a series of tensile tests on specially designed graphite-epoxy unidirectional laminates. The design was such that the specimens would preferentially fail first by fiber breakage and later by matrix splitting. The AE signals for each of these events was analyzed and some typical results are reported. Patterns characteristic of each failure mechanism were noted for both the time signatures and the corresponding frequency spectra. Author

N78-23149*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PREDICTION OF MOISTURE AND TEMPERATURE CHANGES IN COMPOSITES DURING ATMOSPHERIC EXPOSURE
Stephen S. Tompkins, Darrel R. Tenney, and Jalaiah Unnan (George Washington Univ.) Apr. 1978 32 p refs Presented at the 5th ASTM Symp. on Composite Mater.: Testing and Design, New Orleans, 20-22 Mar. 1978
(NASA-TM-78711) Avail: NTIS HC A03/MF A01 CSCL 11D

The effects of variations in diffusion coefficients, surface properties of the composite, panel tilt, ground reflection, and geographical location on the moisture concentration profiles and average moisture content of composite laminates were studied analytically. A heat balance which included heat input due to direct and sky diffuse solar radiation, ground reflection, and heat loss due to reradiation and convection was used to determine the temperature of composites during atmospheric exposure. The equilibrium moisture content was assumed proportional to the

relative humidity of the air in the boundary layer of the composite. Condensation on the surface was neglected. Histograms of composite temperatures were determined and compared with those for the ambient environment. Author

N78-23150# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
TRANSVERSE FRACTURE BEHAVIOR OF GRAPHITE-ALUMINUM COMPOSITES Interim Report
Maurice F. Amateau and Dennis L. Dull 15 Mar. 1978 58 p refs
(Contract F04701-77-C-0078)
(AD-A052062; TR-0078(3726-03)-1; SAMSO-TR-78-69) Avail: NTIS HC A04/MF A01 CSCL 11/6

A determination was made of the transverse tensile strength of graphite-aluminum composites produced from various fiber and matrix compositions and by a variety of processing methods. Processing methods included the standard Ti-B chemical vapor deposition process and modifications to that process, the sodium process, and the nickel-coated fiber method. Precursor rayon, pitch, high-modulus polyacrylonitrile (PAN) and low-modulus PAN fibers were investigated, as well as 201, 6061, and 1100 aluminum-alloy matrices. The transverse fracture strength is influenced by the processing method and the type of fiber but not by the matrix alloy. Those processes and fibers that promote fiber-matrix reaction result in the highest transverse strength. The fractured surfaces, as examined by scanning electron microscopy, revealed fiber-matrix separation and fiber pullout as the dominant features of low-transverse-strength composites. Fiber splitting and the absence of fiber pullout were characteristic of the high-transverse-strength composites.
Author (GRA)

N78-23151# Army Missile Research and Development Command, Redstone Arsenal, Ala.
FRACTURE MECHANICS DESIGN HANDBOOK FOR COMPOSITE MATERIALS
Dallas G. Smith and Bobby R. Mullinix 26 Sep. 1977 129 p refs
(AD-A051866; DRDMI-T-78-6) Avail: NTIS HC A07/MF A01 CSCL 20/11

This design manual is directed toward the needs of practicing engineers and stress analysts. Basic information on the philosophy and theory of the fracture mechanics of composite materials including such topics as common definitions, elastic solutions, damage zone effects, and fracture toughness testing are included. However, the major emphasis is placed on applications. Several techniques and the most applicable solutions presently available for use in the fracture mechanics of composite materials are documented with details covering their application and accuracy. Author (GRA)

N78-23152# United Technologies Research Center, East Hartford, Conn.
EVALUATION OF TANTALUM FIBER REINFORCED Si3N4 Final Report, 1 Mar. 1976 - 1 Mar. 1977
John J. Brennan 1 Apr. 1977 68 p refs
(Contract N62269-76-C-0104)
(AD-A051657; UTRC-R77-912538-4; NADC-75207-30-A) Avail: NTIS HC A04/MF A01 CSCL 11/5

Ceramic materials, by virtue of their high melting points and oxidation resistance, can offer large gains in gas turbine performance, provided some serious limitations can be overcome. These are poor thermal shock resistance and, more critically, low impact strength. Hot-pressed silicon nitride, currently the leading candidate for use as a high temperature vane material, has not only good oxidation resistance but also very good thermal shock resistance for a ceramic material. However, its use is still limited by its relatively low impact strength. It is the solution of this problem that UTRC has emphasized in the current contract with NADC on improving the impact strength of Si3N4 through the use of fiber or wire reinforcements. This approach provides energy absorption modes not available in monolithic materials. By tailoring the properties of the composite it is possible not only to maximize energy absorption during impact but to control the type of fracture as well. Small fragments breaking out of vanes are probably tolerable under abnormal impact loads whereas total failure is unacceptable. Author (GRA)

N78-23153# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Mechanics and Surface Interactions Branch.
CHARACTERIZATION OF COMPOSITE LAMINATES USING TUBULAR SPECIMENS Interim Report, 1 Jan. - 1 Dec. 1976
H. T. Hahn and J. Erikson Aug. 1977 56 p refs
(AF Proj. 2307)
(AD-A051646; AFML-TR-77-144) Avail: NTIS HC A04/MF A01 CSCL 11/4

Properties of a unidirectional graphite/epoxy (T300/5208) composite are characterized using tubular specimens. The elastic compliances based on the average invariants are found to describe fairly accurately the elastic behavior under various combined loadings. The equality between the tension and compression compliances and the symmetry of the compliance tensor are also established to within the experimental scatter. The matrix/interface-controlled failure is characterized by a second-order polynomial including a first-order term. This failure criterion agrees with the experimental observation that the compressive loading perpendicular to the fibers can increase the longitudinal shear stress required for failure. Author (GRA)

N78-23154# Naval Surface Weapons Center, White Oak, Md.
FRACTURE IN CARBON-EPOXY COMPOSITES Annual Report, 1 Oct. 1976 - 30 Sep. 1977
J. R. Lowney and J. F. Goff 30 Sep. 1977 43 p refs
(AD-A052144; NSWC/WOL/TR-77-179; AR-1) Avail: NTIS HC A03/MF A01 CSCL 11/2

Samples of graphite/epoxy composite from NRL and DRNSRDC/Carderock were analyzed optically and electrically. The NRL samples, which were notched, were fractured by tension while their electrical conductivity was monitored. The results showed that initial fracture was matrix cracking rather than fiber breakage. A fracture model based on a hierarchy of elementary failure mechanisms is being formulated.
Author (GRA)

N78-23155# Technion Research and Development Foundation Ltd., Haifa (Israel).
MECHANICAL BEHAVIOR OF MULTIMATERIAL COMPOSITE SYSTEMS, INTERLAMINAR BEHAVIOR Final Technical Report, 1 Jan. - Nov. 1977
Ori Ishai, Dan Peretz, and Shlomit Gali Oct. 1977 74 p refs
(Grant DA-ERO-76-G-062)
(AD-A052140) Avail: NTIS HC A04/MF A01 CSCL 11/1

Interlaminar stress characteristics within a bonded doubler model were evaluated. The study covered the inelastic range of the adhesive up to initiation of its visco-plastic flow. The analytical solution was derived by an iterative procedure, using a linear FEM program which follows a non-linear effective stress-strain relationship. This relationship was based on uniaxial test results of the bulk adhesive, which were found to correlate with corresponding in-situ characteristics of the adhesive.
Author (GRA)

N78-23156# California Univ., La Jolla. Dept. of Applied Mechanics and Engineering Sciences.
MECHANICS OF COMPOSITE MATERIALS Annual Technical Report, Jul. 1976 - Jun. 1977
G. A. Hegemier 1977 71 p refs
(Contract F49620-76-C-0024)
(AD-A051132; AFOSR-78-0206TR) Avail: NTIS HC A04/MF A01 CSCL 11/4

This report summarizes the results of a theoretical study of wave propagation, diffusion, and damage accumulation in composite materials. Author (GRA)

N78-23157 National Technical Information Service, Springfield, Va.
LAMINATES. PART 1: LAMINATED PLASTICS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1972 - Mar. 1978
Diane M. Cavagnaro Mar. 1978 244 p Supersedes NTIS/PS-77/0164 and NTIS/PS-76/0192
(NTIS/PS-78/0202/8; NTIS/PS-77/0164; NTIS/PS-76/0192)
Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 11D

The fabrication, development, and properties of any type of plastic laminate is covered. The term, plastic laminate, is defined

as any laminate using only plastic or reinforced plastics as the laminating materials. The use of reinforced plastics, chemical reactions and properties, performance evaluations, bonding, and physical, structural, and mechanical properties are among the topics studied. This updated bibliography contains 239 abstracts. GRA

N78-23158 National Technical Information Service, Springfield, Va.
LAMINATES. PART 2: OTHER MATERIALS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Mar. 1978
Diane M. Cavagnaro Mar. 1978 154 p Supersedes NTIS/PS-77/0165 and NTIS/PS-76/0193
(NTIS/PS-78/0203/6; NTIS/PS-77/0165; NTIS/PS-76/0193) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 11D

The bibliography cites studies of all types of laminates other than plastic laminates. The majority of these studies cover laminates comprising a plastic or reinforced plastic and a glass or metal. Reports cover fabrication; performance; design; bonding; and the mechanical, physical, and structural properties. GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N78-23159 Carnegie-Mellon Univ., Pittsburgh, Pa.
ALUMINIDE COATINGS ON GAMMA PRIME/DELTA DIRECTIONAL EUTECTICS Ph.D. Thesis
Homi Cawas Bhedwar 1977 149 p
Avail: Univ. Microfilms Order No. 7803451

The relationship between the process variables and the property of oxidation resistance was investigated for aluminide-coated gamma prime/delta directional eutectics, by the control of the coating microstructure. It was found that the microstructure ultimately controlled the oxidation resistance, irrespective of the manner in which the microstructure was processed. The structure/property relationship was shown to exist in regimes of successively deteriorating property, with structures within a regime demonstrating similar oxidation behavior. The overall research was divided into two main areas: (1) the effect of the processing variables on the coating microstructure, (2) the effect of the coating microstructure on the oxidation resistance of gamma prime/delta directional eutectics. Dissert. Abstr.

N78-23160 Illinois Univ., Urbana-Champaign.
OSCILLATIONS IN THE CATALYTIC OXIDATION OF HYDROGEN Ph.D. Thesis
Paul Clement Garrigan 1977 133 p
Avail: Univ. Microfilms Order No. 7803999

Oscillations in the nonisothermal oxidation of hydrogen on catalytic foils were experimentally observed in a heated tubular reactor. For oxygen-rich feeds flowing past platinum foils, dynamic behavior (including oscillations) was influenced by both the initial catalytic activity and changes in activity due to the history of the catalyst. Generally, for tests having smaller initial activity the range of gas temperatures and compositions yielding oscillations and the number of disparate oscillatory behaviors were greater than for those tests having large initial activity. Nearly symmetric oscillations, relaxation oscillations, multipeak oscillations, and, of special interest, chaotic states were observed. Dissert. Abstr.

N78-23161 Illinois Univ. at Chicago Circle, Chicago.
ASYMPTOTIC ANALYSIS OF QUIESCENT AND BOUNDARY LAYER IGNITION OF SOLID FUELS Ph.D. Thesis
Rajesh Kumar Ahluwalia 1977 149 p
Avail: Univ. Microfilms Order No. 7805480

The governing equations for quiescent ignition of a semi-infinite solid fuel, boundary layer ignition of a fuel slab, and thermal ignition of a spherical solid fuel in contact with a quiescent oxidizing medium were analyzed by the Laplace asymptotic method. An asymptotic ignition theory for impervious solid fuels which has the ingredients of heterogeneous surface and gas phase reaction theories, and admits the possibility of simultaneous reaction ignition of a solid fuel is proposed. The asymptotic technique was extended to the study of ignition characteristics of an impervious spherical solid fuel in contact with a quiescent hot oxidizing medium. The model is used to study the ignition of coal particles in a typical MHD-open-cycle combustor environment. The effects of the initial coal temperature, combustor pressure, particle size, and combustor temperature on ignition times are discussed. Dissert. Abstr.

N78-23162 Iowa State Univ. of Science and Technology, Ames.
COULOMETRIC DETECTION IN LIQUID CHROMATOGRAPHY Ph.D. Thesis
John H. Larochelle 1977 187 p
Avail: Univ. Microfilms Order No. 78-05944

A packed, tubular, platinum electrode was applied as a coulometric detector for forced flow liquid chromatography. At flow rates less than 2 ml/min the detector operated with 100% electrolytic efficiency for reactions which are limited by the convective diffusional processes of mass transport at the electrode surface. The coulometric detector was applied to the determination of Cu and Fe in standard solutions prepared from pure Cu and Fe; and solutions of two standard reference materials from the National Bureau of Standards. Separations were obtained by cation exchange liquid chromatography. The precision and accuracy obtained for analyses with the coulometric detector were nearly an order of magnitude better than that which is usually obtained with a photometric detector. Dissert. Abstr.

N78-23163 Iowa State Univ. of Science and Technology, Ames.
USE OF A SEMICONDUCTOR LASER IN INFRARED SPECTROSCOPY Ph.D. thesis
Rex Neil Morris 1977 156 p
Avail: Univ. Microfilms Order No. 7805953

A semiconductor laser has certain properties which makes its use desirable as a continuous monitor of atmospheric pollutants. This thesis examines the ease with which a semiconductor laser can be incorporated and used in an experimental setup. Reproducibility and maintenance problems are examined and the continuous monitoring capabilities of a semiconductor laser are discussed. Infrared absorption lines of N2O, SO2, and H2S are observed from low pressure to a total pressure of one atmosphere when mixed with room air. The analytical parameters S and gamma are determined for some lines of N2O and V sub o, S, and gamma are determined for several absorption lines of SO2. Also values of V sub o are obtained for several H2S absorption lines. These parameters should lead to more reliable measurements in atmospheric pollution monitoring. Dissert. Abstr.

N78-23164 Indiana Univ., Bloomington.
A SELECTIVE SPECTRAL-LINE MODULATION TECHNIQUE FOR CONTINUUM-SOURCE ATOMIC ABSORPTION SPECTROMETRY Ph.D. Thesis
Ronald Lee Cochran, II 1977 243 p
Avail: Univ. Microfilms Order No. 7805565

A technique which promises to greatly reduce the detected background signal and the problems deriving from it is selective spectral-line modulation (SLM) and it is the subject of this research. The relative freedom of this SLM device from both line and broad-band spectral interferences is demonstrated, and a simple multi-element absorption experiment is performed. A one-flame version of this SLM system was tested in which both analytic solution aerosol and droplets of modulating solution are introduced into the same long-path flame cell. Also described is the construction and design of a modified version of the SLM system. Important noise characteristics of this device are evaluated, and a preliminary study of limiting system noise sources is performed. A thorough evaluation of a 300-W Eimac lamp was performed. Dissert. Abstr.

N78-23165 Indiana Univ., Bloomington.
ISOTOPE RATIO DETERMINATIONS USING GAS CHROMATOGRAPHY-MASS SPECTROMETRY Ph.D. Thesis
Dwight Earl Matthews 1977 161 p

Avail: Univ. Microfilms Order No. 78-05609

Isotope ratios for carbon, hydrogen, nitrogen, and oxygen can be determined with poor to good precision (10.0-0.5%) by gas chromatography-mass spectrometry (GCMS). To obtain consistently a precision of 0.5% or better, several sources of error must be considered. In the examples studied, settling times (selected mass within 50 ppm of target value) of 10-200 msec were successfully measured. Anomalies in power supply performance, in which pseudo-stable periods more than 100 msec in length preceded large instabilities, were detected. Residual voltage instabilities as small as 20 ppm were found. Ion counting deadtime counts losses, a practical paralyzable counting system which contains a pulse height discriminator can be characterized as having an effective deadtime which can be very different from the detector output pulse width, even taking negative values. Dissert. Abstr.

N78-23166 Georgia Univ., Athens.

PART 1: EFFECTS ON GAS CHROMATOGRAPHIC PEAKS OF ELECTRIC FIELDS APPLIED ACROSS CHOLESTERIC LIQUID CRYSTAL STATIONARY PHASES. PART 2: EFFECTS OF PRESSURE, TEMPERATURE, ADSORBENT SURFACE, AND MOBILE PHASE COMPOSITION ON THE SUPERCRITICAL FLUID CHROMATOGRAPHIC FRACTIONATION OF MONODISPERSE POLYSTYRENES Ph.D. Thesis

James Earl Conaway 1977 203 p

Avail: Univ. Microfilms Order No. 7805992

The present work qualitatively confirmed effects using cholesteryl laurate, cholesteryl 10-undecenoate, and cholesteryl benzoate and suggests that they may be found for all cholesteric liquid phases. In addition, the peak-fronting phenomenon was found to be a function of both the carrier gas and the applied column potential. The present work shows that these separations could be performed on both derivatized and non-derivatized silica packings, and that no steric exclusion effects contributed to the separations. In addition, the use of both isopropanol and cyclohexane as moderators is found to produce more nearly complete elution of polystyrene oligomers. Non-linear pressure programming is found to produce more nearly regular elution of an oligomeric series, while linear downward temperature programming is found to produce irregular elution near the critical point. Dissert. Abstr.

N78-23167 Cornell Univ., Ithaca, N. Y.

POLYPEPTIDE SEQUENCING UTILIZING A LIQUID CHROMATOGRAPH/MASS SPECTROMETER/COMPUTER SYSTEM Ph.D. Thesis

Bobby Gerald Dawkins 1977 115 p

Avail: Univ. Microfilms Order No. 7806329

Progress made in key steps toward the development of an automatic method for polypeptide sequencing was ascertained, utilizing an on-line liquid chromatograph/mass spectrometer/computer (LC/MS/COM) system. A few nanomoles of the polypeptide were degraded, chemically or enzymically, to smaller peptides (2 to 10 residues) that could be handled by the mass spectrometer. The mixture of degradation products was treated to form the acetylated oligopeptide methyl esters. The mixture of derivatized oligopeptides was then separated by high pressure liquid chromatography and the sequence of the original polypeptide was deduced by computer manipulation of the chemical ionization (CI) spectra taken continuously on a portion of the LC effluent, the LC solvent being used as the CI reagent gas. With the LC directly coupled to the MS through a capillary-splitter interface, the LC effluent was continuously monitored to automate the separation-detection-identification steps. Dissert. Abstr.

N78-23168 Georgia Univ., Athens.

A STUDY OF THE CHROMATOGRAPHIC BEHAVIOR OF A HIGH PRESSURE PENTANE-VAPOR MOBILE PHASE AND A NITROGEN-PHOSPHORUS-SPECIFIC GAS CHROMATOGRAPHIC DETECTOR Ph.D. Thesis

Bruce Peter Semonian 1977 171 p

Avail: Univ. Microfilms Order No. 78-06038

N-Pentane vapor was used as a mobile phase in high pressure gas chromatography to separate some polynuclear aromatic hydrocarbons at both sub- and super- critical temperatures. Short columns (3.8 and 15.2 cm) were employed to reduce effects of column pressure-drop. Column efficiencies were very high. At higher velocities a problem attributed to sampling resulted in reduced efficiency. Column efficiency appeared to be independent of pressure, a result attributed to pressure-induced, infinite-diameter-column effect. Maxima in plots of the distribution ratio vs column pressure were related to pressure-dependent physical and chemical effects. Increases in column temperatures resulted in decreases in the distribution ratio for all pressures tested, in agreement with normal gaschromatographic behavior. Dissert. Abstr.

N78-23169 Cornell Univ., Ithaca, N. Y.

SECONDARY ION MASS SPECTROMETRIC STUDIES OF GROUP III - GROUP V SEMICONDUCTOR MATERIALS Ph.D. Thesis

Gerald Joseph Scilla 1977 172 p

Avail: Univ. Microfilms Order No. 7806318

Secondary ion mass spectrometry (SIMS) is a new and versatile technique which has potential applications in a variety of areas. The potential of SIMS relative to the problems arising in semiconductor technology, specifically III-V materials, was explored and is described. This investigation has demonstrated the feasibility of SIMS for applications in this area. The capabilities of the CAMECA IMS-300 SIMS instrument were explored with the emphasis on determining their applicability to semiconductor technology. In addition, the feasibility of employing the CAMECA for surface oxide analysis was demonstrated. Thus, surface studies, depth profiling, and ion imaging were utilized to provide significant information thereby contributing a more basic insight into the processing of materials, fabrication of devices, and the evaluation of failure mechanisms. Dissert. Abstr.

N78-23170*# National Aeronautics and Space Administration, Washington, D. C.

DETERMINATION OF MICRO AMOUNTS OF IRON, ALUMINUM, AND ALKALINE EARTH METALS IN SILICON CARBIDE

H. Hirata and M. Arai May 1978 17 p refs Transl. into ENGLISH from Bunseki Kagaku (Japan), v. 16, no. 8, 1967 p 820-825 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Matsushita Electric Industrial Co. Ltd., Osaka

(Contract NASw-2790)

(NASA-TM-75303) Avail: NTIS HC A02/MF A01 CSCL 07D

A colorimetric method for analysis of micro components in silicon carbide used as the raw material for varistors is described. The microcomponents analyzed included iron soluble in hydrochloric acid, iron, aluminum, calcium and magnesium. Samples were analyzed by the method, and the results for iron and aluminum agreed well with the N.B.S. standard values and the values obtained by the other company. The method can therefore be applied to the analysis of actual samples. Author

N78-23171*# Pittsburgh Univ., Pa. Dept. of Physics and Astronomy.

MEASUREMENTS OF THE O+ PLUS N2 AND O+ PLUS O2 REACTION RATES FROM 300 TO 900 K

Aikwo Chen, Rainer Johnsen, and Manfred A. Biondi [1977] 13 p refs

(Grants NGL-39-001-137; DAAG29-78-G-0044)

(NASA-CR-157006; APP-68) Avail: NTIS HC A02/MF A01 CSCL 07D

Rate coefficients for the O(+) + N2 atom transfer and O(+) + O2 charge transfer reactions are determined at thermal energies between 300 K and 900 K difference in a heated drift tube mass spectrometer apparatus. At 300 K the values K(O(+) + N2) = (1.2 plus or minus 0.1) x 10 to the negative 12 power cubic cm/sec and k(O(+) + O2) = (2.1 plus or minus 0.2) x 10 to the negative 11 power cubic cm/sec were obtained, with a 50% difference decrease in the reaction rates upon heating to 700 K. These results are in good agreement with heated flowing afterglow results, but the O(+) + O2 thermal rate coefficients are systematically lower than equivalent Maxwellian rates inferred by conversion of nonthermal drift tube and flow drift data. Author

N78-23172*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EXPERIMENTAL AND ANALYTICAL STUDY OF NITRIC OXIDE FORMATION DURING COMBUSTION OF PROPANE IN A JET-STIRRED COMBUSTOR

N. T. Wakelyn, Casimir J. Jachimowski, and Charles H. Wilson May 1978 23 p refs

(NASA-TP-1181; L-12052) Avail: NTIS HC A02/MF A01 CSCL 07D

A jet-stirred combustor, constructed of castable zirconia and with an Inconel injector, was used to study nitric oxide formation in propane-air combustion with residence times in the range from 3.2 to 3.3 msec and equivalence ratios varying from 0.7 to 1.4. Measurements were made of combustor operating temperature and of nitric oxide concentration. Maximum nitric oxide concentrations of the order of 55 ppm were found in the range of equivalence ratio from 1.0 to 1.1. A finite-rate chemical kinetic mechanism for propane combustion and nitric oxide formation was assembled by coupling an existing propane oxidation mechanism with the Zeldovich reactions and reactions of molecular nitrogen with hydrocarbon fragments. Analytical studies using this mechanism in a computer simulation of the experimental conditions revealed that the hydrocarbon-fragment-nitrogen reactions play a significant role in nitric oxide formation during fuel-rich combustion. Author

N78-23173# Delaware Univ., Newark. H. Fletcher Brown Lab.

HIGH RESOLUTION VACUUM ULTRAVIOLET SPECTROSCOPY OF SMALL MOLECULES Interim Report

W. H. Parkinson, D. E. Freeman, and K. Yoshino 1 Dec. 1977 5 p refs

(Contract F49620-77-C-0010)

(AD-A051843; AFOSR-78-0443TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

A 6.65 meter vacuum spectrograph has been installed and a wavelength resolution of 0.005 A attained. Absorption spectra of N2 below 1000 A have been rotationally analyzed, and homogeneous perturbations identified; rotational line broadening in certain bands indicates the presence of predissociation at about 105/cm above the N2D-N2D dissociation limit. The absorption spectra of binary rare gas mixtures have been photographed and interpreted in terms of transitions within van der Waals molecules, from their bound ground electronic states to bound or free excited electronic states near the first and second atomic resonance levels of xenon and krypton.

Author (GRA)

N78-23174# Hull Univ. (England).

RATE CONSTANTS FOR ELEMENTARY STEPS IN HYDROCARBON OXIDATION

Roy R. Baldwin, Joan P. Bennett, and Raymond W. Walker Oct. 1977 13 p Presented at the Intern. Combust. Symp., 16 Oct. 1977

(Grant AF-AFOSR-2450-73)

(AD-A051172; AFOSR-78-0218TR) Avail: NTIS HC A02/MF A01 CSCL 07/3

A review is given of the four main types of reaction which are important in determining the distribution of products in the oxidation of hydrocarbons: (1) free-radical attack on the hydrocarbon RH; (2) decomposition of the radical R by C-C homolysis; (3) reaction of R radical with O2 to form the conjugate alkene; (4) reaction of R radical with O2 to give O-heterocycles and other oxygenated products. Rate constants for these types of reaction, obtained from studies of the oxidation of C2-C4 hydrocarbons and neopentane, are applied to predict the yields of products in the oxidation of pentane. Author (GRA)

N78-23175# Massachusetts Univ., Amherst. Astronomy Research Facility.

INFRARED EMISSION SPECTROSCOPY OF LOW PRESSURE GASEOUS DISCHARGES

Peter Hansen, Hajime Sakai, and John Strong Hanscom AFB, Mass. AFGL 1 Nov. 1977 39 p

(Contract F19628-76-C-0087; AF Proj. 2310)

(AD-A051135; UMASS-ARF-77-303; AFGL-TR-77-0251; Scientific-1) Avail: NTIS HC A03/MF A01 CSCL 07/4

A Michelson interferometer is used to measure infrared radiation in emission from a gaseous discharge column. The discharge column is contained in a 30 meter pathlength cell using a 12 meter central electrode. By optically triple passing, the equivalent pathlength achieved through the discharge column is 36 meters. Spectral resolution near Delta nu approx. 1/cm is obtained. Sample spectra in the 1800 - 8000/cm region are presented. The discharge column consists of a 1 meter diameter steel tube with a central electrode. It is powered by an AC supply. Power dissipation ranges from 1 to 4 kilowatts. Due to the discharge geometry, pressure is limited to the range of 0.1 to 0.6 torr; however, broad adjustments in current density are possible over this pressure range. Author (GRA)

N78-23176# National Physical Lab., Teddington (England). Div. of Chemical Standards.

THE RELATIVE EVAPORATION RATES OF SOLUTES AND WATER FROM DILUTE AQUEOUS SOLUTION AT 25 C

R. C. Pemberton and J. F. Counsell Jul. 1977 19 p refs Sponsored by Anglian Water Authority

(NPL-Chem-73/77) Avail: NTIS HC A02/MF A01

The relationship between the relative evaporation rates of water and the solutes ethanol, 1-propanol, 1-butanol, ethylacetate and diethyl ether was established. The relative humidity was chosen as an easily monitorable quantity to which to relate the non-equilibrium vapor phase concentrations of the organic substances present in the liquid phase. Both equilibrium and non-equilibrium measurements were carried out. In the equilibrium experiments a ventilating gas was passed slowly through a dilute solution of an organic substance. In the non-equilibrium experiments the gas, with an initially fixed input humidity, was passed over the solution at various flow rates taking up quantities of water and solute which were dependent on the flow rate. The vapor samples obtained in these experiments were analyzed for both water and the organic substance by gas chromatography. A relationship between the increase in humidity of the gas and the take up of organic substance was established. Author (ESA)

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N78-23177 California Univ., Los Angeles.

THE INFLUENCE OF PRIOR COLD WORK ON THE CREEP CHARACTERISTICS OF AISI 304 AUSTENITIC STAINLESS STEEL Ph.D. Thesis

Olawunmi Ajaja 1977 197 p

Avail: Univ. Microfilms Order No. 7802587

The creep behavior of cold worked Type 304 stainless steel was investigated at 69-241.3 MN/sq m and 677-760 C. Constant stress tensile creep testing was done on annealed specimens and specimens which were prestrained 2, 4, 6, 8 and 10% in tension at room temperature. The microstructures at various creep conditions were investigated using transmission electron microscopy. Cold work was observed to have significant effects on the primary and secondary creep behavior only at the lowest stresses investigated. The substructural developments associated with transient creep were investigated with the TEM. A brief analysis of the precipitation occurring during creep is presented. A new creep model is proposed. Dissert. Abstr.

N78-23178 Colorado School of Mines, Golden.

THE RELATIVE ION CURRENT TECHNIQUE FOR MASS SPECTROMETRIC MEASUREMENTS OF THE THERMODYNAMIC PROPERTIES OF MOLTEN ALLOYS Ph.D. Thesis

Jerry Leroy Blattner 1976 113 p

Avail: Univ. Microfilms Order No. 7802794

A time-of-flight mass spectrometer fitted with a Knudsen cell inlet was used for the characterization and application of the relative ion current technique for activity and second law partial molar heat of mixing determinations of liquid metallic systems. The magnitude and sensitivity of the error in the relative ion current method were investigated for various adjustable parameters and uncertainties of measurements. Errors in the partial molar heats of mixing were found to be very dependent upon the width of the temperature range studied and the uncertainty of the ion intensities measured. The relative ion current technique was used to study a single component of four binary alloys:

Cu-In, Cu-Ga, Cu-Si, and Sn-Si. The activities and partial molar heats of mixing of the second component were calculated by the integration of the alpha and beta functions. Dissert. Abstr.

N78-23179 Pennsylvania State Univ., University Park.
EFFECT OF ELECTROCHEMICAL DEOXIDATION ON STEEL DESULFURIZATION Ph.D. Thesis
Roy A. Christini 1977 216 p
Avail: Univ. Microfilms Order No. 7803313

The effect of electrochemical deoxidation on steel desulfurization has been examined through the use of the following galvanic cell: Fe(1) + O ZrO2(CaO) Mo-MoO2. The ZrO2 - (CaO) is a solid oxide electrolyte and has been used as an oxygen control device to study the sulfur-oxygen exchange reaction. (S(--) + [O]=[S] + (O(--)). By applying an em± across the galvanic cell, it is possible to electrochemically pump oxygen into or out of the liquid iron. Deoxidation drives the above reaction to the left thus lowering the metal sulfur content and increasing the slag sulfur content. The sulfur changes in both the metal and slag phases were monitored as a function of time.
Dissert. Abstr.

N78-23180 Illinois Univ., Urbana-Champaign.
HYDROGEN EMBRITTLEMENT IN NIOBIUM Ph.D. Thesis
Steven Allan Gahr 1977 103 p
Avail: Univ. Microfilms Order No. 7803997

An experimental study was carried out to determine the effect of hydrogen on the mechanical properties and fracture of niobium in the temperature range 77 K to 773 K. Tensile tests and fractographic studies were carried out to relate the macroscopic properties to the microscopic fracture mode of hydrogen embrittled alloys. At low temperature (T less than 300 K) the macroscopic properties and microscopic fracture will be shown to be consistent with the stress induced precipitation and cleavage of brittle beta hydride at the advancing crack front. Tests carried out at elevated temperatures (T greater than 450 K) indicate that a ductile to brittle transition occurs at a critical hydrogen concentration of H/Nb = 0.30. A higher hydrogen concentration is required to cause embrittlement at temperatures above 573 K, and no embrittlement (based on both macroscopic and microscopic measures of ductility) is observed above 673 K. Dissert. Abstr.

N78-23181 Colorado School of Mines, Golden.
THERMODYNAMIC PROPERTIES OF ZINC-BEARING COMPOUNDS AND SLAGS RELATED TO ELECTROTHERMIC ZINC SMELTING Ph.D. Thesis
William Scott Moser 1976 214 p
Avail: Univ. Microfilms Order No. 7802801

A classical transpiration technique was utilized to determine the standard Gibbs free energy equation for the following reactions over the temperature range 1281-1525 K (J/mole Zn): ZnAl2O4 sub(s) + CO sub(g) = CO2 Sub(g) + Zn sub(g) + Al2O3 sub(s), (Del G sub T)sub 2 = 232,086 - 119.66T (plus or minus 7kJ/mole); ZnCa2Si2O7 sub(s) + CO sub(g) = CO2 sub(g) + Zn sub(g) + 2CaSiO3 sub(s), (Del G sub T) sub 3 = 271,019 - 159.79T (plus or minus 7kJ/mole); 1/2Zn2SiO4 sub(s) + CO sub(g) = CO2 sub(g) + Zn sub(g) + 1/2SiO2 sub(s), (Del G sub T) sub 4 = 222,726 - 133.55T (plus or minus 8kJ/mole). Evaluation of available equilibrium data and further transpiration results for carbon monoxide reduction of zinc oxide were coupled to redetermine the standard Gibbs free energy change for the following reaction over the temperature range 865-1525 K as follows (J/mole Zn); ZnO sub(s) + CO sub(g) + CO2 sub(g) + Zn sub(g), (Del G sub T) sub 1 = 20.056 - 89.467T - 8.786TlnT + 0.02109 T sq. + 403,800/T - 0.000003293 T cu. (plus or minus 2kJ/mole). Combination of the above data and established thermodynamic data for the CO-CO2-O2 system resulted in new expressions for the standard Gibbs free energies of formation for the zinc compounds.
Dissert. Abstr.

N78-23182 Colorado School of Mines, Golden.
A TRANSPIRATION-MASS SPECTROMETRIC TECHNIQUE FOR THE DETERMINATION OF THE THERMODYNAMIC PROPERTIES OF CHLORIDE VAPOR TRANSPORT REACTIONS Ph.D. Thesis
Bruce Schiller 1976 197 p
Avail: Univ Microfilms Order No. 7802803

A new transpiration-mass spectrometric technique for the study of chloride vapor transport reactions was developed. A flow model which relates measured ion intensities to equilibrium partial pressures has been derived. This new technique has been utilized to study the thermodynamics of vaporization in the copper-chlorine, lead-chlorine, and lead-iron-chlorine systems. The available thermodynamic data for the copper-chlorine and lead-chlorine systems have been critically reviewed. As a result of this study, several inconsistencies in the published data were resolved, and better thermodynamic data for these systems are now available.
Dissert. Abstr.

N78-23183 Illinois Univ., Urbana-Champaign.
STRESS-CORROSION CRACKING OF AN ALPHA-PHASE COPPER ALLOY IN AMMONIACAL SOLUTIONS Ph.D. Thesis
Hua-Sou Tong 1977 171 p
Avail: Univ. Microfilms Order No. 7804177

Many alloy systems undergo both inter and transgranular stress corrosion cracking, and it was suggested that the two types occur by different mechanisms, the film rupture model being suggested for I-SCC and a mechanism which involves brittle mechanical failure for T-SCC. This possibility was studied in a specific system, namely annealed Cu-30Zn in various ammoniacal solutions. Fractographic and acoustic emission (AE) studies were carried out for both modes of cracking, and significant differences were observed. In the case of T-SCC, transgranular cleavage-like fracture was observed. The observation of crack arrest markings on the fracture surface, and studies of AE on bend specimens in which cracking occurred within single grains, indicated that crack propagation is mechanical in nature and occurs by discontinuous cleavage. It is consistent with the suggestion that a mechanism which involves mechanical cleavage is operative in T-SCC. Dissert. Abstr.

N78-23184 Purdue Univ., Lafayette, Ind.
ANALYSIS OF RESIDUAL STRAINS IN Fe-2Ni-6.5Ti MARTENSITE AND THE ABSENCE OF LONG-RANGE ORDER IN Fe-31Ni Ph.D. Thesis
Vilakkudi Veeraraghavan 1977 182 p
Avail: Univ. Microfilms Order No. 7803293

The X-ray peaks of Fe-23at.%Ni-6.5at.%Ti martensite formed from austenite ages 10 min. at 710 C were recorded using a precision diffractometer technique exploiting the orientation relationship between the austenite and martensite. The diffraction profiles indicated the superposition of a narrow and a broad component peak. Atomic ordering in bulk austenitic single crystal samples of composition Fe-31at.%Ni was investigated using X-ray and neutron diffraction techniques. Samples were annealed between 450-550 C for time periods between 1.5 h and 55 days. Dissert. Abstr.

N78-23185 Rensselaer Polytechnic Inst., Troy, N. Y.
MICROSEGREGATION IN Al-Zn-Mg ALLOYS Ph.D. Thesis
Adolf Ernest Wirsing 1977 142 p
Avail: Univ. Microfilms Order No. 7802867

Nucleation and growth of precipitates at heterogeneous sites involves the redistribution of solute on the scale of microstructural features. The present investigation measures microsegregation through a statistical treatment of microprobe analyses of random microstructural locations. The effect of precipitation at intragranular heterogeneous nucleation sites as well as at grain boundaries is reflected in the data. A ternary Al-6.88%Zn-2.35 Mg alloy was investigated in heat treatments involving varying the quench rate from solution treatment temperatures of 510 C or 465 C to room temperature (air, oil, iced brine) and aging at 180 C. The results show that the development of microsegregation is dominated by the vacancy concentration and mobility which can be varied through the solution treatment temperature, quench rate, aging temperature, and alloying additions. Dissert. Abstr.

N78-23186 Ohio State Univ., Columbus.
EVALUATION OF THE DYNAMIC IDEAL PLASTIC STATE IN AISI 4340 STEEL Ph.D. Thesis
Dennis Lee McGarry 1977 331 p
Avail: Univ. Microfilms Order No. 7805885

The attainment of the ideal plastic state is reported to be a requirement in forming localized plastic flow (plastic instability). A real material can attain this state during a dynamic test according to the following equation: d sigma = (delta sigma/delta epsilon) d epsilon + (delta sigma/delta epsilon)d epsilon + (delta sigma/delta T)dT less than or equal to 0. It is concluded that the plastic instabilities in AISI 4340 steel are not due to normal strain rate effects or thermal softening due to internal heat generated during a dynamic test. Some microscale instability such as dislocation breakaway from solute atoms is suspected to cause the necessary drop in flow stress which results in unstable flow. Dissert. Abstr.

N78-23187 Iowa State Univ. of Science and Technology, Ames.
LOW TEMPERATURE HEAT CAPACITY OF SCANDIUM AND ALLOYS OF SCANDIUM Ph.D. Thesis
Tsun-Wah Edmund Tsang 1977 140 p
Avail: Univ. Microfilms Order No. 7805974

The heat capacity of three electrotransport purified scandium samples was measured from 1 to 20K. The resultant electronic specific heat constant and Debye temperature are 10.337 plus or minus 0.015 mJ/gm-atom sq K and 346.7 plus or minus 0.8K respectively, and these values are believed to be truly representative of intrinsic scandium. Alloying studies were also carried out to investigate the band structure of scandium based on the rigid band model, with zirconium to raise the electron concentration and magnesium to lower it. The results are then compared to the theoretical band structure calculations. Low temperature heat capacity measurements made on some dilute Sc-Fe alloys reveal an anomaly in the C/T vs sq T plot. The C vs T curve shows no evidence of magnetic ordering down to 1K, and electrical resistance measurement from 4 to 0.3K also indicates that no magnetic ordering took place. Dissert. Abstr.

N78-23188 Wisconsin Univ., Madison.
A DYNAMIC RATE THEORY FOR THE RESPONSE OF METALS DURING STEADY STATE AND PULSED IRRADIATION Ph.D. Thesis
Nasr Mostafa Ghoniem 1977 353 p
Avail: Univ. Microfilms Order No. 7802959

A state variable approach to the formulation of a fully dynamic rate theory is used to describe the behavior of point defects, interstitial loops, vacancy loops and voids under different irradiation conditions. Based on the theory, and utilizing efficient numerical methods for stiff non-linear differential equations, a computer code, TRANSWELL, was developed to solve for the behavior of point defects and the microstructure of metals under a wide range of material and irradiation conditions. Another computer code, handles and processes the data generated by TRANSWELL, and displays it in the form of three dimensional and contour plots. Experimental data, selected from the open literature on three metals (316 SS, Al and Ni) irradiated with neutrons, heavy ions and electrons, are compared to the results of computations. Dissert. Abstr.

N78-23189 Georgia Inst. of Tech., Atlanta.
A STUDY OF THE INFLUENCE OF LARGE WIRE DRAWING PLASTIC STRAINS ON DISLOCATION SUBSTRUCTURES AND MECHANICAL PROPERTIES OF ALUMINUM AND ITS DILUTE ALLOYS Ph.D. Thesis
Shailendra Krishna Varma 1977 211 p
Avail: Univ. Microfilms Order No. 7804530

The relationship between microstructure and strain hardening was studied for aluminum and its dilute alloys subjected to room temperature wire drawing deformation to the strains of 5. The materials studied were pure aluminum Al-0.2Mg, Al-0.6Fe and EC aluminum. The additions of Mg and Fe were made to determine separately the effects of small amounts of soluble and insoluble alloying elements. Complete stress strain curves were obtained at various wire drawing intervals and structures were characterized by transmission electron microscopy, selected area diffraction and X-ray diffraction. Dissert. Abstr.

N78-23190 Pennsylvania Univ., Philadelphia.
REACTIONS BETWEEN PLATINUM AND REFRACTORY OXIDES Ph.D. Thesis
Michael Francis Brady 1977 164 p
Avail: Univ. Microfilms Order No. 7806560

High temperature reactions between platinum and refractory oxide (Ta2O5, ZrO2, Al2O3) were investigated, using weight gain, X-ray diffraction, metallographic, and microprobe techniques. The reactions were examined over the temperature range 1300 C to 1500 C. Weight gain and layer thickness measurements indicated the reactions were parabolic with time. All experimental evidence indicated that diffusion through the intermetallic-compound layer(s) and the Pt solid solution was the rate controlling step. Diffusion coefficients measured in the Ta-Pt rich solid solution and TaPt3 agreed with other literature data. Diffusion coefficients measured in the Zr-Pt rich solid solution were about 100 times higher than those in the Ta-Pt rich solid solution. Dissert. Abstr.

N78-23191 Northwestern Univ., Evanston, Ill.
LOW CYCLE FATIGUE RESPONSE OF HIGH STRENGTH-LOW ALLOY STEEL Ph.D. Thesis
David John Quesnel 1977 406 p
Avail: Univ. Microfilms Order No. 7805321

Three treatments of HSLA steel were investigated in parallel, namely the as received hot rolled plate, (HR); the cold rolled 50%, (CR 50%); and the recrystallized structure resulting from annealing the CR 50% for two hours at 700 C, (AN). It was observed that none of the materials investigated reached a cyclic saturation in terms of both structure and stress. The logarithmic rate of stress change with cycling was a smooth function of strain amplitude and was essentially constant for any given amplitude, throughout the life. The mechanism of interstitial depinning and forest hardening were observed to compete at intermediate strains to provide essentially stable response. Only softening was observed for the Cr50% case. The comcept of an anelastic component was introduced into the low cycle fatigue measurements. Dissert. Abstr.

N78-23192 Engineering Sciences Data Unit, London (England).
FATIGUE OF WROUGHT AND CAST Ti-6Al-4V TITANIUM ALLOY (IN BENDING AND UNDER AXIAL LOADING)
Nov. 1977 42 p
(ESDU-77027; ISBN-0-85679-200-4) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $434.50

Data on the fatigue strength of the six per cent aluminum, four per cent vanadium, titanium alloy at normal temperature are presented in terms of (K sub t)(S sub a)/(f sub t) plotted against N and, where pertinent, the ranges of mean stress values are indicated in terms of (S sub m)/(f sub t). Data are provided for forged bar, rod and sheet, extruded strip and castings. The data are sub-divided according to whether the alloy was annealed or solution treated and age hardened. In all cases details of the specimens from which the data were derived are provided. ESDU

N78-23193*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE ROLE OF THERMAL SHOCK IN CYCLIC OXIDATION
Carl E. Lowell and Daniel L. Deadmore 1978 14 p refs Presented at 153d Meeting of the Electrochem. Soc., Seattle, 21-26 May 1978
(NASA-TM-78876; E-9610) Avail: NTIS HC A02/MF A01 CSCL 11F

The effect of thermal shock on the spalling of oxides from the surfaces of several commercial alloys was determined. The average cooling rate was varied from approximately 240 C per second to less than 1.0 C per second during cyclic oxidation tests in air. The tests consisted of one hundred cycles of one hour at the maximum temperature (1100 or 1200 C). The alloys were HOS-875, TD-Ni, TD-NiCrAl, IN-601, IN-702, and B-1900 plus Hf. All of these alloys exhibited partial spalling within the oxide rather than total oxide loss down to bare metal. Thermal shock resulted in deformation of the metal which in turn resulted, in most cases, in changing the oxide failure mode from compressive to tensile. Tensile failures were characterized by cracking of the oxide and little loss, while compressive failures were characterized by explosive loss of platelets of oxide. This behavior was confirmed by examination of mechanically stressed oxide scales. The thermally shocked oxides spalled less than the slow cooled samples with the exception of TD-NiCrAl. This material failed in a brittle manner rather than by plastic deformation. Author

N78-23194# SRI International Corp., Menlo Park, Calif.
A STUDY TO DETERMINE THE MECHANISMS OF CORROSION OF COPPER-NICKEL ALLOYS IN SULFIDE-POLLUTED SEAWATER Annual Report, 2 Feb. 1977 - 1 Feb. 1978
D. D. MacDonald, B. C. Syrett, and S. S. Wing 1 Feb. 1978 165 p refs
(Contract N00014-77-C-0046; NR Proj. 036-116; SRI Proj. PYU-6077)
(AD-A051833) Avail: NTIS HC A08/MF A01 CSCL 11/6

The corrosion of 90:10 Cu:Ni and 70:30 Cu:Ni alloys in flowing seawater (1.62 m/s) has been studied as a function of oxygen concentration using the linear polarization, ac impedance, and potential step methods for measuring the polarization resistance. Satisfactory agreement is obtained between these three semicontinuous techniques and measurements of weight loss, thereby demonstrating the suitability of electrochemical methods for monitoring the corrosion rate of cupronickel alloys in seawater. The high-nickel alloy is found to be more corrosion resistant than the 90:10 Cu:Ni alloy under the conditions employed, provided that (O2) < or = 6.60 mg/1. In oxygen-saturated seawater, the superior behavior of the 70:30 Cu:Ni alloy is no longer observed. The loss in corrosion resistance of the 70:30 Cu:Ni alloy is correlated with a shift in the corrosion potential, to a value more noble than the 'break-away potential' (defined here as the potential at which a sudden increase in anodic current occurs on sweeping the potential in the active to noble direction). GRA

N78-23195# California Univ., Los Angeles. Dept. of Materials.
A NOTE ON THE ANISOTROPIC ACOUSTIC EMISSION BEHAVIOR OF HSLA STEELS
Kanji Ono, M. Shibata, and M. A. Hamstad Feb. 1978 15 p refs
(Contract N00014-75-C-0419)
(AD-A051825; TR-78-02) Avail: NTIS HC A02/MF A01 CSCL 11/6

Elongated MnS inclusions in HSLA steel produces no detectable burst emission activity when a steel test sample is stressed in tension or in compression along the longitudinal direction. This is in sharp contrast to significant burst emission activities when the tensile stress acts normal to the flattened MnS inclusions in the thickness direction samples of the same HSLA steel. The experimental results are consistent with calculations of internal stresses in and around an oblate inclusion. Author (GRA)

N78-23196# Pennsylvania Univ., Philadelphia. Dept. of Metallurgy and Materials.
EFFECT OF RESIDUAL IMPURITIES ON HYDROGEN ASSISTED CRACKING IN HIGH-STRENGTH STEELS Final Report, 8 Dec. 1976 - 7 Dec. 1977
Nikhiles Bandyopadhyay and Charles J. McMahon, Jr. 8 Dec. 1977 39 p refs
(Contract N00019-77-C-0158)
(AD-A051826) Avail: NTIS HC A03/MF A01 CSCL 11/6

Intergranular embrittlement in 4340-type high strength steels (yield strength approximately equal to 200 ksi) has been studied both at room temperature and 77 K. The toughness trough which is the manifestation of one-step temper embrittlement was absent in a high purity steel at room temperature, but it appeared in the 77 K tests. The room temperature test produced no intergranular fracture, but some intergranular facets were found in the 77 K specimens. For commercial steels, the toughness trough occurred in both the room temperature and the 77 K tests. Intergranular fracture in the high purity steel can be produced at room temperature by charging cathodically with hydrogen in sulfuric acid solution. Hydrogen-assisted cracking in the high purity steel showed a high K sub th value (approximately equal to 72 ksi sq root in) in 1 atm H2 at room temperature, which is about a factor of three greater than that observed in any commercial steels. Hence, in this type of steel the resistance to hydrogen-induced cracking can be greatly increased by bringing the impurity effects under control. Author (GRA)

N78-23197# Minnesota Univ., Minneapolis. Dept. of Chemistry.
METAL SURFACE RAMAN SPECTROSCOPY: THEORY
R. M. Hexter and M. G. Albrecht 15 Mar. 1978 76 p refs
(Contract N00014-77-C-0209)
(AD-A051895; TR-1) Avail: NTIS HC A05/MF A01 CSCL 07/4

Studies of the Raman and infrared spectra of several molecules adsorbed to metal surfaces indicate that special selection rules govern these spectra. In the case of infrared reflection adsorption spectroscopy (IRS) as in the related techniques of electron energy loss spectroscopy (ELS) and inelastic electron tunneling spectroscopy (IETS), only modes which develop dipole moment perpendicular to the metal surface can be excited. Both infrared and Raman spectra of oriented metal adsorbates can be used to probe molecular orientation. Depolarization ratios for specific orientations and scattering geometries have been derived and used to analyze the results of several experimental examples. The adsorbed molecule whose Raman spectrum has been most thoroughly studied is pyridine on silver. Using secondary ion mass spectroscopy, we have been able to show that the silver surfaces are atomically quite clean. The case of pyridine adsorbed on Ag is also of interest because of the relative intensity of some of its Raman lines. By comparison with the same lines in liquid pyridine, the intensity is apparently enhanced by a factor of 10000. Several theories of this enhancement are analyzed. GRA

N78-23198# California Univ., San Diego, La Jolla. Institute for Pure and Applied Physical Sciences.
A METALLURGICAL APPROACH TO HIGH TEMPERATURE SUPERCONDUCTIVITY Final Report, 1 Oct. 1976 - 31 Dec. 1977
Bernd T. Matthias, Zachary Fisk, David C. Johnston, and Robert N. Shelton 28 Feb. 1978 32 p refs
(Contract F49620-77-C-0009)
(AD-A051923; AFOSR-78-0557TR) Avail: NTIS HC A03/MF A01 CSCL 11/6

A second system of ternary superconductors has been discovered. Their formula is XRh4B4 with X being almost any trivalent transition element. In addition, the superconductor ErRh4B4 first becomes superconducting, then loses it and becomes ferromagnetic at a lower temperature. This phenomenon is a radically new feature for ordered compounds. The properties of these and some closely related superconductors and magnets have been investigated. GRA

N78-23199# TRW, Inc., Cleveland, Ohio. Materials Technology.
EFFECT OF RARE EARTH ADDITIONS ON STRESS CORROSION CRACKING OF 4340 STEEL Technical Report, 17 Jun. 1976 - 16 Jun. 1977
A. A. Sheinker Jan. 1978 55 p refs
(Contract N00014-74-C-0365)
(AD-A052155; ER-7814-3) Avail: NTIS HC A04/MF A01 CSCL 11/6

The addition of rare earth elements was investigated as a method of improving the stress corrosion cracking resistance of high strength steels. The addition of cerium at levels of 0.20 and 0.30 weight percent had only a small effect on the stress corrosion cracking resistance of AISI 4340 steel heat treated to a yield strength of approximately 215 ksi (1480 MPa). The stress corrosion cracking threshold (K(Iscc)) in 3.5 percent sodium chloride solution at room temperature was about the same for the two cerium-bearing steels as it was for 4340 steel without cerium, ranging from 15 to 17 ksi sq root in. The higher cerium (0.30%) material had longer failure times and lower average crack growth rates than the lower cerium (0.20%) material. The failure times and average crack growth rates for the steel without cerium could not be directly compared with those for the two cerium-bearing steels because of crack branching, which occurred only in the material without cerium. However, it was estimated that, in the absence of branching, the failure times for the non-cerium steel would be shorter and the average crack growth rates higher than those for the lower cerium steel. The cerium additions had no effect on the fractographic morphology of stress corrosion cracking, which was intergranular at low stress intensity levels, with an increasing proportion of dimpled rupture as the stress intensity level increased. GRA

N78-23200# Stanford Univ., Calif. Dept. of Materials Science and Engineering.
HYDROSTATIC EXTRUSION Final Report
Erastus H. Lee, Russell L. Mallett, Robert M. McMeeking, Oleg D. Sherby, John C. Shyne, and Robert T. Whalen Mar. 1978 151 p refs
(Contract N00014-75-C-0923; ARPA Order 2783)
(AD-A052056; SU-DMS-77-T-6) Avail: NTIS HC A08/MF A01 CSCL 11/6

The present program is centered on an experimental and analytical study of hydrostatic extrusion. The experimental aspects are described in the first section of this progress report. In the second section we describe the basis for an elastic-plastic code as a means of assessing metal forming operations. This analytical approach is unique and promises to be a very powerful tool in analyzing the extrusion process. Author (GRA)

N78-23201# Technion - Israel Inst. of Tech., Haifa. Material Mechanics Lab.
VISCOPLASTIC CONSTITUTIVE EQUATIONS FOR COPPER WITH STRAIN RATE HISTORY AND TEMPERATURE EFFECTS Interim Report, 1977 - 1978
S. R. Bodner and A. Merzer Jan. 1978 35 p refs
(Grant AF-AFOSR-2607-74)
(AD-A051986; MML-55; AFOSR-78-0422TR; SR-12) Avail: NTIS HC A03/MF A01 CSCL 11/6

Elastic-viscoplastic constitutive equations based on a single internal state variable which is a function of plastic work are used to calculate the response of copper to a six decade change of strain rates over a range of temperatures. Calculations were performed for the conditions of an experimental program on copper by Senseny, Duffy, and Hawley, namely, temperatures ranging from 77 to 523 K and strain rate jumps from .0002/sec to 300/sec at three strain levels. The computed results are in good agreement with the experiments and show similar strain rate and strain rate history effects. Relations are obtained for the temperature dependence of certain parameters in the equations which indicate correspondence between plastic working and temperature and between strain rate sensitivity and temperature. Author (GRA)

N78-23202# Naval Surface Weapons Center, White Oak, Md.
DETERMINATION OF FREE LITHIUM IN Li-B ALLOYS Progress Report
W. P. Kilroy and I. Angres 10 Nov. 1977 19 p refs
(ZR0130101)
(AD-A052053; NSWC/WOL/TR-77-129) Avail: NTIS HC A02/MF A01 CSCL 10/3

A method has been developed for the extraction of the free lithium phase from lithium-boron alloys. This procedure extracts the lithium from the alloy using dry naphthalene - THF mixtures. The lithium is analyzed and the composition of the remaining LixBy compound determined. Author (GRA)

N78-23203# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
MACHINE CASTING OF FERROUS ALLOYS Final Report, 30 Jun. 1976 - 30 Jun. 1977
M. C. Flemings, K. P. Young, J. F. Boylan, R. L. Bye, and M. L. Santor Jun. 1977 99 p refs
(Grant DAAG46-73-C-0110; ARPA Order 2067)
(AD-A051155; AMMRC-CTR-77-31) Avail: NTIS HC A05/MF A01 CSCL 11/6

During this year the basic Rheocasting system, which was fully operational at the beginning of the year, was improved in various ways to increase reliability and productivity. Specific improvements were the addition of a reducing gas in the melting chamber, a shield gas extension nozzle and graphite inserts at the bottom of the Rheocaster to eliminate 'hot spots'. Large quantities of 304 and 440C stainless steel alloys were cast during this period (approximately 800 pounds of 304 and 2000 pounds of 440C) and smaller quantities of other materials were also Rheocast including M2 tool steel, and HS 31 Cobalt base superalloy. Improvements in details and automation of the Thixocasting process were also made during this period. Work subsequently concentrated on casting large quantities of stainless steel into various die materials in order to determine die life and to optimize that die life. GRA

N78-23204# Stanford Research Inst., Menlo Park, Calif.
INVESTIGATION OF SOLID-SOLID REACTIONS IN METAL FILMS ON SILICON Annual Report, 26 Apr. 1976 - 1 May 1977
T. J. MaGee, J. Penk, and R. A. Armistead May 1977 31 p refs
(Contract DAAG29-76-C-0036)
(AD-A051170; ARO-13514.1-MS) Avail: NTIS HC A03/MF A01 CSCL 11/6

Investigations were conducted on solid-solid reactions in gold films evaporated on silicon substrates at deposition temperatures below the eutectic point (370 C). Both air- and vacuum-annealed structures were studied using correlated data from transmission electron microscopy/diffraction (TEM/TED), Auger electron spectroscopy (AES) profiling, and forward current-voltage (I-V) measurements. Results of these experiments show that the grain size in Au films deposited (or annealed) at temperatures from 25 C to 200 C increases from 50 angstrom (min) to saturation size of approximately 1 micro m at temperatures greater than 150 C. GRA

N78-23205# Florida Univ., Gainesville. Dept. of Materials Science and Engineering.
APPLICATION OF EXPERIMENTAL POURBAIX DIAGRAMS TO PREDICTION OF LOCALIZED CORROSION, DEALLOYING AND STRESS CORROSION CRACKING OF ENGINEERING ALLOYS Final Report
Ellis D. Verink, Jr. 12 Nov. 1978 19 p refs
(Contracts N00014-75-C-0820; N00014-68-A-0173-0015; N00014-68-A-0173-0003)
(AD-A051226) Avail: NTIS HC A02/MF A01 CSCL 11/6

Underlying all of these major accomplishments is a philosophy that there is a strong obligation to make corrosion research more cost-effective by providing a framework of theory and practice which will give a capacity for predicting corrosion behavior of engineering alloys at minimum cost in research time or resources. GRA

N78-23206# Indiana Univ., Bloomington. Dept. of Chemistry.
ATOMIC EMISSION SPECTROMETRY OF TRACE METALS USING A NEW KIND OF MICROWAVE-INDUCED HELIUM PLASMA AT ATMOSPHERIC PRESSURE
Andrew T. Zander and Gary M. Hieftje Feb. 1978 26 p refs
(Contract N00014-76-C-0838; Grant NSF CHE-76-10896)
(AD-A051178; Rept-11) Avail: NTIS HC A03/MF A01 CSCL 11/6

A recently described resonant cavity for generating microwave-induced helium plasmas (MIPS) at atmospheric pressure has been evaluated for use in the emission spectrometric determination of metallic elements, and has been found to offer several advantages over alternative designs. The new cavity allows self-ignition of an atmospheric pressure helium MIP. In addition, the plasma which is formed exhibits significantly improved operational stability and is considerably less susceptible to injected aerosol samples. The helium MIP was used in conjunction with a single-shot microarc sample atomizer. With this combination, analytical calibration curves for Zn, Pb, Mn, Mg, Cu, Ca, and Na are linear over 2 to 5 orders of magnitude of concentration; also, detection limits for these elements are equal to or better than those obtainable with other MIPs. As with most MIPs, the ionization of easily ionized elements must either be overcome using ionization suppressants or exploited through use of ion emission lines. Interference from refractory elements is lower than exhibited by most MIPs. Author (GRA)

N78-23207# California Univ., Berkeley. Dept. of Mechanical Engineering.
ON THE HARDENING RESPONSE IN SMALL DEFORMATION OF METALS
D. A. Caulk and P. M. Naghdi Jan. 1978 50 p refs
(Contract N00014-75-C-0148)
(AD-A051498; UCB/AM-78-1) Avail: NTIS HC A03/MF A01 CSCL 11/6

This paper is concerned with a special class of hardening response functions for small deformation of elastic-plastic materials, its application to isotropic metals, and comparison of the theoretical results with experimental cyclic stress-strain curves for two different metals. The theoretical development is carried

out within the scope of the existing purely mechanical theory for the 'rate-independent' response of elastic-plastic materials, which admits the existence of a single loading function, as well as certain accepted idealizations. After summarizing the basic equations for small deformation, detailed attention is given to the development of a special form of the hardening response function, motivated mainly by the observation that the stress-strain curves for uniaxial cyclic loading of a fairly large class of metals attain -- after several cycles -- the so-called saturation hardening. GRA

N78-23208# Sandia Labs., Albuquerque, N. Mex.
EXPERIMENTAL APPLICATION OF DESIGN PRINCIPLES IN CORROSION RESEARCH
W. H. Smyrl and S. L. Pohlman 1977 20 p refs Presented at 20th Ann. AICHE Meeting, New York, 13 Nov. 1977
(Contract EY-76-C-04-0789)
(SAND-77-0680C; Conf-771102-7) Avail: NTIS HC A02/MF A01

Experimental design criteria for corrosion investigations were based on established principles for systems that have uniform, or nearly uniform, corrosive attack. Scale-up or scale-down was accomplished by proper use of dimensionless groups that measure the relative importance of interfacial kinetics, solution conductivity, and mass transfer. These principles were applied to different fields of corrosion which include materials selection, testing, and protection; and to a specific corrosion problem involving attack of a substrate through holes in a protective overplate. ERA

N78-23209# Ames Lab., Iowa.
ELECTROMIGRATION OF HYDROGEN AND DEUTERIUM IN VANADIUM, NIOBIUM, AND TANTALUM Ph.D. Thesis
Craig Leebens Jenson Oct. 1977 137 p refs
(Contract W-7405-eng-82)
(IS-T-778) Avail: NTIS HC A07/MF A01

The electric mobility and effective valence of hydrogen and deuterium in vanadium, niobium, tantalum, and three niobium-tantalum alloys were measured. A resistance technique was used to directly determine the electric mobility of hydrogen and deuterium at 30 C while a steady state method was used to measure the effective valence. The use of mass spectrographic techniques on a single specimen which contained both hydrogen and deuterium greatly increased the precision with which the isotope effect in the effective valence could be measured. ERA

N78-23210# Addis Translations International, Portola Valley, Calif.
IMPROVING THE WEAR-RESISTANCE CHARACTERISTICS OF METAL SURFACES THROUGH VACUUM PRODUCTION TECHNIQUES
H. Bollinger, D. Schulze, and R. Wilberg [1977] 17 p refs Transl. into ENGLISH from Neue Huette (East Ger.), v. 21, no. 3, Mar. 1976 p 145-149 Sponsored by DOE Prepared for Battelle Pacific Northwest Labs., Richard, Wash.
(BNWL-tr-277; CB-35431) Avail: NTIS HC A02/MF A01

The coating of metals and intermetallic compounds as well as organic and inorganic nonmetallic materials on given substrates by means of vacuum techniques has assumed an increasing technical importance in the last decade. The chief area of application of vacuum technology coating methods is represented by thin film techniques in electronics. By means of modern methods based on more efficient vacuum technology equipment the deposition of metal films up to more than 50 micrometers thick is possible without difficulty. Thus, vacuum coating techniques and the selective changing of the properties of metallic surfaces through vacuum technologies offer an alternative to electroplating and flame spraying. In principle, all metallic substances and intermetallic compounds can be precipitated out in a vacuum, and aluminum, zinc, magnesium, titanium, cadmium, and lead can be economically deposited especially well in thick layers. ERA

N78-23211# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Werkstoff-Forschung.
CORROSION FATIGUE OF TITANIUM ALLOYS
D. Munz [1976] 16 p refs
Avail: NTIS HC A02/MF A01

Titanium alloys are susceptible to stress corrosion cracking and corrosion fatigue in aqueous halide solutions especially in a precracked state. The fatigue limit of smooth specimen can be up to 15 % lower than in air. But also no effect and sometimes a higher fatigue strength was observed. For all titanium alloys an effect of aqueous environments on crack propagation rate can be expected. At high delta K crack propagation rate da/dN increases with decreasing frequency, at medium delta K the da/dN-delta K-curves of different frequencies intersect, at low delta K crack propagation rate is independent of frequency. The superposition model cannot explain the onset of cyclic stress corrosion cracking at delta K sub ISCC less than (1-R)K sub ISCC. Fractographic and electrochemical investigations can give valuable information on the corrosion fatigue process. Crack propagation under varying amplitudes in a corrosive environment is very complex and needs further investigations on delay effects and the transition effects after change of frequency or wave form. Author (ESA)

N78-23212# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
FATIGUE TESTS WITH TURNED, NOTCHED SPECIMENS OF FORGED ALUMINUM 3633-4 OF VARIOUS SURFACE TREATMENTS
Nils Larsson and Lars Jarfall Oct. 1977 39 p refs
(FFA-TN-HU-1729) Avail: NTIS HC A03/MF A01

Fatigue testing of turned and notched (K sub t = 1.7) test specimens, which were glass bead peened, steel shot peened or sandblasted and, in certain cases, also anodized and varnished is reviewed. In all, six different surface treatments were investigated. The material was rough-forged aluminum satisfying SAAB material specification 3633-4 and was re-heat-treated from 3633-7. The fatigue testing was carried out partly as constant amplitude testing with R = 0 and partly as variable amplitude testing with JA37 flight program. Among the different surface treatments, glass bead peening (with or without subsequent anodizing + varnishing) achieved the best fatigue strength. Blasting + anodizing resulted in the lowest fatigue strength. Author (ESA)

N78-23213# National Physical Lab., Teddington (England). Div. of Chemical Standards.
THE ANALYSIS OF HIGH-PURITY IRONS, MILD STEELS AND LOW ALLOY STEELS BY X-RAY EMISSION SPECTROSCOPY. PART 5: THE DETERMINATION OF TRACE IMPURITIES IN LOW ALLOY STEELS
Joyce M. Griffiths and H. R. Whitehead Jan. 1978 27 p refs
(NPL-Chem-78) Avail: NTIS HC A03/MF A01

The establishment of suitable calibrations for the determination of several trace impurities in low alloy steels by X-ray fluorescence is described. Data obtained from reference samples with different iron base matrices were used. Author (ESA)

N78-23214# National Bureau of Standards, Washington, D. C.
THE MACROSCOPIC DETECTION OF CORROSION IN ALUMINUM AIRCRAFT STRUCTURES WITH THERMAL NEUTRON BEAMS AND FILM IMAGING METHODS
Donald A. Garrett 7 Dec. 1977 42 p refs Sponsored in part by Naval Air Systems Command
(PB-277074/1; NBSIR-78-1434) Avail: NTIS HC A03/MF A01 CSCL 11F

The primary objective was to determine the feasibility of detecting corrosion in aluminum naval aircraft components with neutron radiographic interrogation and the use of standard corrosion penetrameters. Secondary objectives included the determination of the effect of object thickness on image quality, the defining of minimum levels of detectability, and a preliminary investigation of a means whereby the degree of corrosion could be quantified with neutron radiographic data. GRA

N78-23215 National Technical Information Service, Springfield, Va.
CORROSION OF STAINLESS STEEL, VOLUME 1. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - 1976
Mona F. Smith Mar. 1978 258 p
(NTIS/PS-78/0232/5) Copyright. Avail: NTIS

HC $28.00/MF $28.00 CSCL 11F

Research is cited on stainless steel composition, mechanical properties, structure, and testing in relation to corrosion. The majority of research concerns nuclear reactor materials. However, corrosion studies in coal gasification plants, rocket propellant tanks, underwater cables, batteries, and geothermal systems are also included. GRA

N78-23216 National Technical Information Service, Springfield, Va.
CORROSION OF STAINLESS STEEL, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1977 - Mar. 1978
Mona F. Smith Mar. 1978 79 p Supersedes NTIS/PS-77/0183 and NTIS/PS-76/0114
(NTIS/PS-78/0233/3; NTIS/PS-77/0183; NTIS/PS-76/0114) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 11F

Federally-funded research on stainless steel composition, mechanical properties, structure, and testing in relation to corrosion is cited. The majority of research concerns nuclear reactor materials. In addition, corrosion studies in coal gasification plants, rocket propellant tanks, underwater cables, batteries, and geothermal systems are included. GRA

N78-23217 National Technical Information Service, Springfield, Va.
SUPERALLOYS, VOLUME 1. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - 1976
Mona F. Smith Mar. 1978 242 p
(NTIS/PS-78/0198/8) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 11F

Federally-funded research studies on coatings, nuclear materials, testing, fabrication, corrosion, and mechanical properties of superalloys are cited. Research on composites from superalloys are included. GRA

N78-23218 National Technical Information Service, Springfield, Va.
SUPERALLOYS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Feb. 1978
Mona F. Smith Mar. 1978 92 p Supersedes NTIS/PS-77/0160; NTIS/PS-76/0109 and NTIS/PS-75/179
(NTIS/PS-78/0199/6; NTIS/PS-77/0160; NTIS/PS-76/0109; NTIS/PS-75/179) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 11F

Citations on cobalt-, iron-, and nickel-based superalloys are presented. The manufacture, melting, casting, powder metallurgy, forging, and welding of these alloys are covered. Corrosion, high and low temperature properties, physical, and mechanical properties of these materials are included. Applications discussed are nuclear reactors, gas turbines, superconducting machinery, and heat exchangers. This updated bibliography contains 171 abstracts. GRA

N78-23219 National Technical Information Service, Springfield, Va.
SUPERALLOYS, VOLUME 3. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Mar. 1977 - Feb. 1978
Mona F. Smith Mar. 1978 178 p Supersedes NTIS/PS-77/0161 and NTIS/PS-76/0108
(NTIS/PS-78/0201/0; NTIS/PS-77/0161; NTIS/PS-76/0108) Copyright Avail: NTIS HC $28.00/MF $28.00 CSCL 11F

For abstract, see N78-23218.

N78-23220 National Technical Information Service, Springfield, Va.
SUPERALLOYS. VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1974 - Mar. 1977
Mona F. Smith Mar. 1978 292 p Supersedes NTIS/PS-78/0198; NTIS/PS-78/0199; NTIS/PS-76/0107
(NTIS/PS-78/0200/2; NTIS/PS-78/0198; NTIS/PS-78/0199; NTIS/PS-76/0107) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 11F

Abstracts in this compilation cover worldwide studies on superalloy fabrication, manufacture, powder metallurgy, corrosion, coatings, physical, mechanical, and high temperature properties. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N78-23221 Carnegie-Mellon Univ., Pittsburgh, Pa.
POLYMERIZATION OF ORIENTED MONOLAYERS Ph.D. Thesis
Stephan Alan Letts 1977 366 p
Avail: Univ. Microfilms Order No. 78-03456

Oriented monolayers of vinyl stearate and octadecyl acrylate were polymerized at the nitrogen-water interface. The first quantitative determinations of conversion were made in a polymerizing monolayer film. Experiments were conducted on a film balance. Polymerization was initiated photolytically with ultraviolet radiation. Measurements of surface pressure, surface potential, and relative surface viscosity were used to characterize the reaction products and determine reaction kinetics. Attempts to calibrate the surface viscometer with a molecular weight range of poly(vinyl stearate) samples were unsuccessful due to lack of reproducibility. Thin layer chromatography was used to identify the reaction products. Transferring the reacted monolayer films by the Blodgett multilayer technique to internal reflection plates allowed characterization with infrared spectroscopy. Dissert. Abstr.

N78-23222 Rutgers - The State Univ., New Brunswick, N. J.
HIGH PRESSURE X-RAY DIFFRACTION STUDIES OF CRYSTALLINE POLYMERS Ph.D. Thesis
Tai Ping Sham 1977 243 p
Avail: Univ. Microfilms Order No. 78-05127

A pressure standard, utilizing the change in d-spacing of a molecular crystal, hexamethylenetatramine (HMT), was developed along with other modifications made on the diamond anvil high pressure cell in order to improve the state of hydrostatic pressure inside the cell and the ratio of the diffracted beams to the background intensities. Using these techniques, polyethylene and polyundecanamide (Nylon 11) were studied at pressures up to 19,000 kg/sq cm and temperatures to 300 C. The pressure-strain relations for both polyethylene and Nylon 11 in different crystalline directions were established, compared, and related to the intermolecular bonding. Heating and crystallization of polyethylene under conditions of high pressure were also investigated and Nylon 11 was studied at temperatures up to the melting temperatures at different pressures. Dissert. Abstr.

N78-23223 Florida Univ., Gainesville.
DIELECTRIC CHARACTERISTICS OF PZT 95/5 FERROELECTRIC CERAMICS AT HIGH PRESSURES Ph.D. Thesis
Richard Kent Spears 1977 133 p
Avail: Univ. Microfilms Order No. 7806755

The room temperature dielectric properties of a ferroelectric ceramic having a normal composition of 95 atomic % lead zirconate and 5 atomic % lead titanate (called PZT 95/5) with a niobium dopant was examined at high hydrostatic pressures using a tetrahedral anvil apparatus. The small signal and high electric field dielectric properties at pressures over 4 GPa were determined. When the dielectric constant was plotted versus pressure, there was a gradual increase up to the ferroelectric-antiferroelectric transition. The dielectric constant then fell and gradually leveled off. At approximately 2 GPa, a dielectric discontinuity was observed on every test. This was initially attributed to a phase change; however, due to the fact that it was irreversible and that the specimen was extremely fragile, the cause was attributed to the collapse of pores in the ceramic. Dissert. Abstr.

N78-23224 Michigan Univ., Ann Arbor.
YIELD AND IMPACT BEHAVIOR OF GLASSY AMORPHOUS POLYMERS Ph.D. Thesis
Needamangalam Srinivasan Sridharan 1976 233 p
Avail: Univ. Microfilms Order No. 7804816

The pre-yield anelastic response in an uniaxial tensile test of glassy polycarbonate and other glassy polymers was studied with special emphasis on its correlation with yield behavior and impact toughness. Structural changes accompanying deformation were also studied using wide angle X-ray scattering and electron microscopy. The plastic strain in the pre-yield region of glassy polymers was shown to be negligible. It was suggested that the three element model incorporating the plastic, elastic, and anelastic components of strain is more general when applied to crystalline polymers as well. The variation of the plastic volume change with true stress was shown to provide a natural, self consistent definition of yielding. A composite index was developed to estimate the relative impact toughnesses for different polymers. The index was shown to parallel the impact toughness values for nine glassy polymers of engineering importance.
Dissert. Abstr.

N78-23225 Northwestern Univ., Evanston, Ill.
MOLECULAR ORIGINS OF ELECTRICAL POLARIZATION IN POLY (ACRYLONITRILE) Ph.D. Thesis
Samuel Isaac Stupp 1977 193 p
Avail: Univ. Microfilms Order No. 78-05331

Techniques thermally stimulated discharge (TSD) and infrared attenuated total reflection spectroscopy (ATR) were used to characterize the molecular origins of this polarization in poly (acrylonitrile) (PAN). TSD spectra of electrically polarized PAN films revealed the onset of current flow at temperatures ranging between 60 C and 100 C depending upon the strength of external electric fields used to induce persistent polarization. These currents were attributed to spatial randomization of nitrile groups that become preferentially aligned along the electric field direction during polarization. These currents were suggested to originate from a dipolar contribution based on experimental detection of nitrile group orientation anisotropy loss by ATR. Theoretical calculations based on classical theories of static permittivity were carried out, and found to predict a lower magnitude of dipolar electrical polarization in PAN than observed experimentally by both TSD and ATR. Dissert. Abstr.

N78-23226 Iowa State Univ. of Science and Technology, Ames.
ANALYTICAL APPLICATIONS OF RESINS CONTAINING AMIDE AND POLYAMINE FUNCTIONAL GROUPS Ph.D. Thesis
Gene Michael Orf 1977 121 p
Avail: Univ. Microfilms Order No. 78-05960

Resins were prepared by chemically bonding N,N-dialkylamides and polyamine functional groups to Amberlite XAD-4. These resins were applied to the concentration of metal ions from dilute aqueous solution and the rapid separation of metal ions by high speed, liquid chromatography with continuous on-line detection of the eluent stream. A dibutyl amide resin was used for the separation of uranium(VI), thorium(IV), and zirconium(IV) from each other and several other metal ions. Uranium(VI) and thorium(IV) were determined in the presence of large excesses of foreign metal ions and anions. A practical application of the amide resin was studied by determining uranium in low grade uranium ores. The amide resin was also used for the selective concentration of gold(III) from sea water.
Dissert. Abstr.

N78-23227 Akron Univ., Ohio.
THE IMPACT RESISTANCE OF RUBBER-MOUNTED STARBLOCK COPOLYMER PLASTICS Ph.D. Thesis
Robert Francis Felis 1977 140 p
Avail: Univ. Microfilms Order No. 78-04925

Rubber-modified starblock copolymer plastics were prepared using high vacuum anionic polymerization techniques. The ratio of isoprene to styrene was varied from zero to thirty percent while all other synthetic parameters were held constant. The molecular weight of the arms was also varied in a series of compounds containing a fixed ratio of styrene to isoprene. In addition to this, starblock plastic star systems were prepared by growing acrylonitrile out from living divinyl benzene centers after the crosslinking reaction was established. Also, the influence of sample dimensions upon the impact properties was studied for homogeneous polystyrene, rubber-modified high impact polystyrene (HIPS), and starblock copolymer plastics. It was found that starblock plastics of the type produced in this work have much lower impact properties than commercial HIPS system and also exhibit much less crazing upon fracture. Dissert. Abstr.

N78-23228 Wisconsin Univ., Madison.
NONLINEAR STRESS RELAXATION OF UNCROSSLINKED AND CROSSLINKED RUBBERY POLYMERS AND RELATED PHENOMENA Ph.D. Thesis
Carl Raymond Taylor 1977 304 p
Avail: Univ. Microfilms Order No. 78-02990

Two different types of polymer systems were studied to gain experimental insight into the structure of entanglement constraints and the motion of high molecular weight polymer chains in both uncrosslinked and crosslinked environments. The first was uncrosslinked polyisobutylene of high molecular weight; the second was a series of crosslinked networks of ethylene-propylene copolymer and of polybutadiene which contained specially introduced unattached macromolecules. The nonlinear viscoelastic behavior of uncrosslinked polyisobutylene in the plateau and terminal zones was studied by stress relaxation experiments in simple extension at stretch ratios ranging from about 1.15 to 2. Dissert. Abstr.

N78-23229 Case Western Reserve Univ., Cleveland, Ohio.
CHLOROSULFONATED BLOCK COPOLYMERS Ph.D. Thesis
Michael Judah Covitch 1977 200 p
Avail: Univ. Microfilms Order No. 7730980

Solution chlorosulfonations of an ABA block copolymer (A = polystyrene, B = poly(ethylene-butene-1) and a specially prepared sample of poly(ethylene-butene-1) (designated as P-MB) comparable to the midblock (B block) were carried out in CCl4 with SO2 and Cl2 at 15 C in the presence of a catalytic quantity of pyridine. The chlorosulfonated samples were analyzed for extent of reaction, molecular weight effects, and degree of hydrolysis by vacuum X-ray fluorescence, infrared spectroscopy, and gel permeation chromatography. Dynamic mechanical (110 Hz) and dielectric (50-50,000 Hz) measurements were obtained from films which were solvent cast from tetrahydroduran and vacuum dried at 50-60 C for at least 48 hours. Results are interpreted in terms of a model involving specific dipole-dipole interactions of sulfonyl chloride moleties which are covalently bonded to polymer chains. Dissert. Abstr.

N78-23230 Akron Univ., Ohio.
MORPHOLOGICAL CHANGES IN TRIBLOCK POLYMERS UPON APPLICATION OF STRESS Ph.D. Thesis
Timothy Terrance Taylor 1977 497 p
Avail: Univ. Microfilms Order No. 78-04931

A model for the morphology of a linear styrene-butadiene-styrene triblock polymer was proposed from the interpretation of its low angle X-ray scattering patterns. An ordered structure was assigned as the morphology, with the arrangement being primarily face centered cubic for both a crosslinked and an uncrosslinked sample. The cell parameters and domain sizes were a = b = c = 1180A, radius = 223A; a = b = c = 1010A, radius = 230A for the crosslinked and uncrosslinked sample respectively. When the samples were elongated by stress, the scattering patterns indicated a slight increase in long range order with the domains deforming in a nonlinear fashion. The mechanism of deformation proposed was basically the same for both the crosslinked and uncrosslinked samples. The differences in the deformation were attributed to the differences in physical behavior of the material between the domains. Dissert. Abstr.

N78-23231*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
KINETICS OF IMIDIZATION AND CROSSLINKING IN PMR-POLYIMIDE RESIN
Richard W. Lauver 1977 24 p refs Presented at the 9th Central Reg. Meeting of the Am. Chem. Soc., Charleston, W. Va., 12-14 Oct. 1977 Submitted for publication
(NASA-TM-78844; E-9561) Avail: NTIS HC A02/MF A01 CSCL 11D

Infrared spectroscopy and differential scanning calorimetry were employed to study the imidization and crosslinking kinetics of norbornenyl-capped, addition-type polyimide resins (designated PMR for polymerization of monomer reactants). The spectral and thermal analyses were performed on resin specimens which had

been isothermally aged at temperatures appropriate for imidization (120 to 204 C) and crosslinking (275 to 325 C). Imidization occurs rapidly (approximately 0.01/min) at short times, while at times longer than approximately 0.5 hour, the rate decreases significantly (approximately 0.0001/min). The crosslinking reaction exhibits first order kinetics during the initial portion of the reaction and its rate appears to be limited by the reversion of the norbornenyl Diels-Alder adduct. The total heat evolved per mole of endcap during crosslinking shows an inverse dependence on the molecular weight of the imide prepolymers. This reflects the effect of endcap dilution and decreased mobility of the larger oligomers. Author

N78-23232# Utah Univ., Salt Lake City. Dept. of Chemistry.
BRILLOUIN SCATTERING AND SEGMENTAL MOTION OF A POLYMERIC LIQUID, II
Y. H. Lin and C. H. Wang 1 Mar. 1978 33 p
(Contract N00014-75-C-0908)
(AD-A051887; TR-16) Avail: NTIS HC A03/MF A01 CSCL 11/9

We have studied the Brillouin scattering spectra of oligomers of polyethylene glycol, along with ethylene glycol. These systems vary greatly in viscosity as well as molecular weight. We have found that except for ethylene glycol (the monomer), the Brillouin frequencies and the linewidths of the rest of oligomers show more or less the same temperature dependence, independent of viscosity and molecular weight. These results indicate that the motion responsible for the hypersonic dispersion and attenuation is localized. We have also developed a theory based upon the Zwanzig-Mori formalism to account for the experimental results. We have then shown that in order to obtain a good agreement between theory and the experiment, the usual Markov approximation describing the dynamic behavior of the memory function cannot be used. Thus, the usual hydrodynamic equations with frequency independent transport coefficients are inadequate in describing the Brillouin scattering spectra of viscous liquids.
Author (GRA)

N78-23233# Utah Univ., Salt Lake City. Dept. of Chemistry.
POLARIZED RAMAN SCATTERING STUDIES OF CHAIN ORIENTATION IN HYDROSTATICALLY EXTRUDED POLYPROPYLENE
Sushil K. Satija and C. H. Wang 1 Mar. 1978 29 p refs
(Contract N00014-75-C-0908)
(AD-A052078; TR-17) Avail: NTIS HC A03/MF A01 CSCL 11/9

It is now established that imposition of hydrostatic pressure can cause substantial changes in the mechanical behavior of polymers. Hydrostatic extrusion has in recent years become a practical technique for altering the mechanical properties of polymers in a controllable manner. Hydrostatic extrusion gives rise to the plastic deformation of polymers and results in changes in molecular orientation as well as texture. At a high extrusion ratio (which is defined as the ratio of the cross sectional area of the virgin specimen to that of the extrudate through the die) the extruded samples are known to have highly oriented fiber structure in which stacks of folded chain crystallites are present. GRA

N78-23234# Utah Univ., Salt Lake City. Dept. of Chemistry.
BRILLOUIN SCATTERING AND SEGMENTAL MOTION OF A POLYMERIC LIQUID, I
Y. H. Lin and C. H. Wang 1 Mar. 1978 35 p
(Contract N00014-75-C-0908)
(AD-A052057; TR-15) Avail: NTIS HC A03/MF A01 CSCL 07/3

The effect of segmental motion on the density-density correlation function of a viscous polymer liquid has been analyzed using a generalized relaxation equation developed by Zwanzig and Mori. It is shown that for polymer liquids of high viscosity Brillouin scattering is closely associated with the structural relaxation associated with the motion of chain segments. A single relaxation time theory is shown to yield good agreement with the experimental results on polypropylene glycol. The torsional motion involving a small number of monomer units is shown to be responsible for the dispersion and attenuation of the hypersonic wave. The fact that the Brillouin scattering spectrum of a polymer liquid is insensitive to the change of molecular weight is discussed. It is shown that temporal modulation of the spatial second moment of the intermolecular or inter-segmental interaction energy is responsible for the relaxation process involved in Brillouin scattering. Author (GRA)

N78-23235# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
EVALUATION OF SOIL RESISTANT COATINGS FOR EXTERIOR AIRCRAFT SURFACES Final Report
E. Charves 2 Jun. 1977 81 p refs
(AD-A051449; NADC-77182-30) Avail: NTIS HC A05/MF A01 CSCL 11/3

Fluorinated polyepoxy and polyurethane base coatings developed by the Naval Research Laboratory, Washington, D.C., were evaluated as possible candidate coatings for use on exterior surfaces of naval aircraft. When laboratory tested against the linear urethane MIL-C-81773B coatings, the fluorinated coatings were found to be lower in initial gloss properties while exhibiting similar properties in adhesion, corrosion resistance, engine and lubricating oil resistance, heat resistance, flexibility, soil resistance and weathering properties. Author (GRA)

N78-23236# Princeton Univ., N. J. Polymer Materials Program.
THE FORMATION AND PROPERTIES OF NETWORK POLYMERIC MATERIALS Technical Report, Mar. 1977 - Mar. 1978
J. K. Gillham Mar. 1978 19 p refs
(Contract N00014-76-C-0200; NR Proj. 356-504)
(AD-A051451; TR-15) Avail: NTIS HC A02/MF A01 CSCL 11/9

A general model for thermosetting materials which relates polymerization to properties is discussed. In particular a phase diagram shows how the four states of matter encountered, (i. e. liquid, rubber, ungelled glass and gelled glass) relate to gelation and vitrification phenomena. The model is extended to rubber-modified thermosetting systems where evidence is presented to show, by control of the time to gelation, a given chemical formulation can provide different morphologies and hence different material behavior. Author (GRA)

N78-23237# Army Inst. of Dental Research, Washington, D. C.
EVALUATION OF RESIN DIE MATERIALS
Stanley G. Vermilyea, Eugene F. Huget, and John Wiskoski, II 9 Mar. 1978 14 p refs
(AD-A051510) Avail: NTIS HC A02/MF A01 CSCL 11/9

Some mechanical properties, physical characteristics and manipulative features of three resin-based die materials were assessed. Advantages afforded by the strength and hardness of the test materials were overshadowed by relatively long setting times, incompatability with certain impression materials and polymerization shrinkage. All dies aged beyond 24 hours were found to be unsuitable for use in precision fixed prosthodontic procedures. Author (GRA)

N78-23238# California Univ., Livermore. Lawrence Livermore Lab.
MATERIALS EVALUATION FOR GEOTHERMAL APPLICATIONS: TURBINE MATERIALS
A. Goldberg and R. E. Garrison 13 Apr. 1977 4 p refs Presented at Geothermal Resources Council, San Diego, Calif., 9 May 1977
(Contract W-7405-eng-48)
(UCRL-79360; Conf-770569-2) Avail: NTIS HC A02/MF A01

A number of candidate turbine materials were evaluated for their resistance to erosion, corrosion, and stress corrosion cracking (SCC) in geothermal brines. These materials include Fe-, Ni-, Co and Ti-base alloys, coatings and ceramics. Tapered wearblades, simulating the leading edge of a turbine blade, are exposed to the direct impact of a two-phase nozzle exhaust. Bent beam SCC specimens, which were constrained in fixtures attached to the wearblade holders, were also exposed to the exhaust. Results of a test series were reported in which acidified liquid brine expanded to atmospheric pressure are reported. Evaluation of the exposed materials indicates that Ti-base alloys show the

most promise for turbine wheel components in the high salinity geothermal environments. ERA

N78-23239# Centre Oceanologique de Bretagne, Brest (France). Dept. Technologie et Developpement Industriel.
QUALIFICATION TESTS FOR SYNTACTIC FOAMS [ESSAIS DE QUALIFICATION DE MOUSSES SYNTACTIQUES]
Jean Croquette Paris Centre Natl. pour l'Exploit. des Oceans 1977 58 p refs In FRENCH; ENGLISH summary
(CNEXO-STR-31) Avail: NTIS HC A04/MF A01

Eight materials were tested, covering all application from 2,000 to 10,000 m. Variations of buoyancy, directly measured in the pressure chamber, give information on the actual behavior of these materials under pressure. Data are presented for density, implosion, buoyancy variations under pressure, thermal cycling and pressure cycling. Author (ESA)

N78-23240# Royal Aircraft Establishment, Farnborough (England).
THE FLEXIBILITY OF WEATHERED RUBBER-COATED FABRICS
J. E. Swallow and M. Webb Feb. 1977 32 p refs
(RAE-TR-77016; BR57343) Avail: NTIS HC A03/MF A01

The effects of 1 year of weathering on the flexibility of rubbercoated fabrics were studied in 208 combinations of base fabric, rubber type, time, site and stress level. Throughout, coated nylon fabrics were thicker, heavier, and less flexible than coated cotton fabrics, the base fabrics being similar in mass per unit area. Fabrics coated with polyurethane or chlorosulphonated polyethylene tended to be thicker than those with natural or neoprene rubbers, while chlorosulphonated polyethylene coated fabrics were the heaviest. Polyurethane stiffened more than the other rubbers on storage or exposure, particularly when used on nylon. Load level had little effect on flexibility. Author (ESA)

N78-23241# Royal Aircraft Establishment, Farnborough (England).
THE BREAKING STRENGTH AND EXTENSION OF WEATHERED RUBBER-COATED FABRICS
J. E. Swallow and M. Webb Mar. 1977 21 p refs
(RAE-TR-77031; BR57342) Avail: NTIS HC A02/MF A01

The breaking strength and extension of a nylon and of a cotton fabric, each coated with natural rubber, neoprene, polyurethane or chlorosulphonated polyethylene and exposed to various weathering conditions, were determined. Although the coated nylon fabrics were stronger and more extensible than the cotton ones, those with natural rubber coating deteriorated at a faster rate when exposed under load. Nylon coated with polyurethane was initially stronger and more extensible than when coated with other rubbers, but in hot moist weathering conditions deteriorated faster. Extension was more severely affected than strength by load during exposure. Author (ESA)

N78-23242# European Space Agency, Paris (France).
STUDY ON FORMATION OF REACTION LAYERS ON METAL SURFACES BY USING A BLENDED LUBRICANT
Heribert Lindinger Mar. 1978 30 p refs Transl. into ENGLISH of 'Untersuch. zur Reaktionsschichtbildung auf Metalloberflaechen durch Schmierstoffadditivierung', DFVLR, Munich Report DLR-FB-77-31, 14 Jul. 1977 Original report in GERMAN previously announced as N78-18222 Original German report available from DFVLR, Cologne DM 16,10
(ESA-TT-465; DLR-FB-77-31) Avail: NTIS HC A03/MF A01

Tests to prove the formation of reaction layers on metal surfaces by a blended ester base oil under the influence of oxygen or nitrogen as environmental medium are discussed. The base oil used was a pentaerythrite heptane acid ester, and the additions were tricresyl phosphate and oleic acid. Testing was made with the four ball wear tester. Aside from determining friction and wear data, wear areas were investigated with the scanning electron microscope, REM, including an additional energy dispersive X-ray analysis, and the Talysurf roughness test equipment. Author (ESA)

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power*, *20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

N78-23243*# Martin Marietta Aerospace, Denver, Colo.
REDUCTION OF LIQUID HYDROGEN BOILOFF: OPTIMAL RELIQUEFACTION SYSTEM DESIGN AND COST STUDY
Apr. 1978 41 p
(Contract NAS10-9049)
(NASA-CR-157000; MCR-77-136-1) Avail: NTIS HC A03/MF A01 CSCL 21D

The refrigeration cycles investigated are referred to as Joule-Thomson cycles because they depend on the J-T effect to produce the low temperatures. Two basic competitive refrigeration cycles were evaluated. The first vents a portion of cold H2 gas to achieve the required precooling; the second uses LN2 for precooling. Both open loop and closed loop cycles were evaluated as well as combinations of venting to supplement the LN2 precooling. All cycles use a H2 compressor to achieve the desired high pressure (1325 psig). The heat compression was removed by cooling water. The high pressure H2 gas was cooled in counter flow heat exchangers by flowing cold H2 to the compressor. Further cooling was achieved for cycles using LN2 by passing H2 vapors through a LN2 heat exchanger. Finally, the high pressure H2 gas was expanded through a J-T valve where a portion of H2 was liquefied. The low pressure H2 gas flow back through the heat exchangers to the compressor is that portion not liquefied and makes up hydrogen gas from the dewar. Author

N78-23244*# Martin Marietta Aerospace, Denver, Colo.
REDUCTION OF LIQUID HYDROGEN BOILOFF: OPTIMAL RELIQUEFACTION SYSTEM DESIGN AND COST STUDY Final Report
Apr. 1978 321 p refs
(Contract NAS10-9049)
(NASA-CR-156999; MCR-77-136) Avail: NTIS HC A14/MF A01 CSCL 21D

A preliminary design and economic analysis of candidate hydrogen reliquefaction systems was performed. All candidate systems are of the same general type; differences and size, compressor arrangement, and amount of hydrogen venting. The potential application of the hydrogen reliquefaction will be to reduce the boil-off from the 850,000 gallon storage dewars at LC-39. Author

N78-23245# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab. Section.
PROPELLANT SURVEILLANCE REPORT LCM-30 A AND B STAGE 1, TP-H1011 Semiannual Report
John A. Thompson Jan. 1978 99 p refs
(AD-A051824; MANCP-388(78)) Avail: NTIS HC A05/MF A01 CSCL 21/9

The purpose of testing was to determine and provide early warning of any serious degradation trends occurring in the propellant for service life predictions. An analysis of all parameters indicates that no potential problems are expected in the propellant for at least two years past the oldest data point. Data stored in the G085 System were plotted utilizing the IBM 360-65 Computer and CAL-COMP Plotter. The data range at any age can be found by suitable inquiry of the G085 System. Each point on the regression plot represents the mean of all samples at that particular age. The number of specimens at each point is indicated on the sample size summary sheet accompanying each regression plot or group of regression plots. Author (GRA)

N78-23246# Naval Weapons Center, China Lake, Calif.
CONVECTIVE BURNING IN PROPELLANT DEFECTS: A LITERATURE REVIEW Final Report, 1 Apr. - 30 Sep. 1977
Harold H. Bradley, Jr. Feb. 1978 105 p refs
(AD-A051867; NWC-TP-6007) Avail: NTIS HC A06/MF A01 CSCL 21/9

This report presents a survey of literature describing the onset and development of convective combustion--one of the

first steps associated with the transition of deflagration-to-detonation of solid propellants. It contains results from experiments using various single pore (or channel) geometry and porous bed geometry, as well as damaged propellant samples. A section describes the results from various analytical models as applied to single pore and porous bed geometries. Attributes that favor convective combustion are presented in the context of: attributes favoring gas flow into the defects, attributes favoring ignition of the pore surfaces, and attributes favoring acceleration of the convective front. Author (GRA)

N78-23247# Princeton Univ., N. J. Dept. of Aerospace and Mechanical Sciences.

SOLID PROPELLANT IGNITION AND OTHER UNSTEADY COMBUSTION INDUCED BY RADIATION

L. DeLuca, T. J. Ohlemiller, L. H. Caveny, and M. Summerfield Nov. 1976 268 p refs

(Grants DA-ARO(D)-31-124-71-G51; DA-ARO(D)-31-124-71-G184; DA-ARO(D)-31-124-73-G109; DAHC04-74-G-0124; DAAG29-76-G-0270)

(AD-A052046; AMS-TR-1192-T) Avail: NTIS HC A12/MF A01 CSCL 21/9

Experimental and analytical investigations were conducted to understand the ignition and nonsteady burning processes that occur at and near the propellant surface, to determine the connection between the ignitability of a propellant and its other nonsteady combustion characteristics, to quantify the peculiarities of radiative ignition, and to develop a means of ranking propellant ignitability. As a result of these investigations, radiative ignition processes have been explained for a wide variety of propellant and test conditions. The stability properties of heterogeneous combustion waves were considered for linear and nonlinear situations. Nonlinear (large disturbances) solid propellant stability boundaries can be immediately defined from the knowledge of the associated restoring function. The restoring function is a property strictly dependent on the nature of the solid propellant. Author (GRA)

N78-23248# Air Force Academy, Colo. Frank J. Seiler Research Lab.

INVESTIGATION OF PLASTICIZER DIFFUSION WITHIN A CYLINDRICAL FUEL PELLET

Robert H. Foglesong and J. Paul Jendrek Aug. 1977 22 p refs

(AD-A051194; FJSRL-TR-77-0019) Avail: NTIS HC A02/MF A01 CSCL 21/9

The investigation of the disappearance of an organic plasticizer from a solid fuel pellet has been undertaken with emphasis on determining the mechanism that most effectively describes this phenomena. Actual experimental data was taken and several mathematical models designed and solved in order to evaluate the physical parameters associated with the disappearance of the plasticizer. Values of the solid state molecular diffusivity and the molecular distribution coefficient for the gas-solid system theorized to be the most appropriate mechanism for plasticizer transfer are presented. Author (GRA)

N78-23249# Argonne National Lab., Ill.

MODIFICATIONS AND COSTS OF CONVERTING TO LOW SULFUR WESTERN COALS

G. N. Reddy and G. C. Krohm 1977 19 p refs Presented at NCA/BCR Coal Conf., Louisville, Ky., 19 Oct. 1977

(Contract W-31-109-eng-38)

(CONF-771024-3) Avail: NTIS HC A02/MF A01

It thus appears that the conversion of existing boilers burning high sulfur Midwestern coals to low-sulfur Western coals is not a simple matter. The difficulties of burning this fuel can be traced to the inherent problems of operating the boiler outside of its designed operating limits. The operating parameters that are affected by coal characteristics are summarized. These factors must be considered carefully when planning conversion of a power plant to burn Western coal: Excessive dusting of coal enroute to power plant; reduced conveyor belt capacity (10-20%), loss of boiler efficiency due to increased moisture (up tp 30%); water side scale buildup due to decreased slagging; increased fouling with high sodium coal; larger dust handling system requirements within the boiler; carbon carryover; decreased electrostatic precipitators efficiency because of the decrease in sulfur trioxide concentrations in the flue gases. ERA

N78-23250# Institute of Gas Technology, Chicago, Ill.

RISER CRACKING OF COAL TO OIL AND GAS

Dennis A. Duncan, Justin L. Beeson, and R. Donald Oberle 1977 8 p refs Presented at Ann. Am. Chem. Soc. Meeting, Chicago, 28 Aug. - 2 Sep. 1977

(Contract EX-76-C-01-1221)

(CONF-770814-10) Avail: NTIS HC A02/MF A01

A short residence time entrained flow process for converting low-rank coal to gases and hydrocarbon liquids that can be used as gasoline blending stock and fuel oil was investigated. In the hydropyrolysis process, lignite was heated concurrently with hydrogen at a high pressure in a helical coil reactor having a predetermined temperature profile to yield ethylene, pyrolysis gasoline, and other products. Results indicate that: (1) fifty percent of the carbon in the feed lignite can be converted to oils and gases at a system operating pressure of 2000 psig, a coil out temperature of from 1400 to 1500 F, and a residence time of approximately 2 second; (2) approximately 15% of the feed carbon reports as oils, and by choice of temperature and hydrogen dilution, some selectivity with respect to the constituents present in the make oil is possible; and (3) high operating temperatures and hydrogen dilutions tend to suppress the appearance of phenol, toluene, and xylene in the make oil. It is concluded that high yields of methane, hydrocarbon oils, and blending gasoline constituents make the hydropyrolysis process economically favorable to pyrolysis of coal. ERA

N78-23251# Los Alamos Scientific Lab., N. Mex.

FUSION ENERGY APPLIED TO SYNTHETIC FUEL PRODUCTION: A REPORT TO THE DOE DIVISION OF MAGNETIC FUSION ENERGY BASED ON A PRELIMINARY STUDY BY AN AD-HOC ADVISORY GROUP

Lawrence A. Booth Oct. 1977 125 p refs Presented at the Conf. on Fusion Energy Appl. to Syn. Fuel Production, Germantown, Md., 9 May 1977

(Contract W-7405-eng-36)

(CONF-770593) Avail: NTIS HC A06/MF A01

The general conclusion is that the potential for utilization of fusion energy for synthetic fuel production is favorable. Three basic methods of hydrogen production are identified: (1) high-temperature electrolysis, (2) thermochemcial cycles, and (3) direct radiolysis. Combinations of these and their use as in combined cycles for electric power generation were considered. Author (ERA)

N78-23252# Institute of Gas Technology, Chicago, Ill.

DEVELOPMENT OF THE STEAM-IRON SYSTEM FOR PRODUCTION OF HYDROGEN FOR THE HYGAS PROCESS Final Status Report, 1 May 1973 - 30 Jun. 1976

Oct. 1977 296 p refs

(Contract EY-76-C-01-1518; Proj. 8920)

(FE-1518-46) Avail: NTIS HC A13 /MF A01

The status of the following eight major tasks is reported: reducing gas generation testing to establish operating conditions for the design of the producer reactor; process design and construction; shakedown operation of the pilot facility; fluidized bed testing to obtain data for the design of the fluidized iron ore beds, lift lines, and seal legs in the steam iron reactor; slurry feed testing to obtain data for design of the char feed system; small scale kinetic testing to evaluate the use of other iron compounds in the steam iron process; char evaluation testing to determine preferred operating conditions for different chars to produce reducing gas for the steam-iron reactor; and computerized analysis evaluation of plant design and operating data. Author (ERA)

N78-23253# Intergroup Consulting Economists Ltd., Winnipeg (Manitoba).

ECONOMIC PRE-FEASIBILITY STUDY: LARGE-SCALE METHANOL FUEL PRODUCTION FROM SURPLUS CANADIAN FOREST BIOMASS. PART 2: WORKING PAPERS

Sep. 1976 249 p refs Prepared in cooperation with SNC, Inc., Montreal (Quebec), Charnell (Gordon S.) and Associates, Vancouver (British Columbia) and Gardiner (S. G.) Engineering Services Ltd., Vancouver (British Columbia)

(NP-22159/2) Avail: NTIS (US Sales Only) HC A11/MF A01; ERDA Depository Libraries

The practicability of using methanol produced from surplus renewable Canadian forest roundwood as a substitute for non-renewable hydrocarbons in meeting Canadian energy requirements is addressed. Titles of the five working papers are: methanol plant technologies, characteristics and costs; resource harvesting; opportunity costs; product demand analysis; and alternative feedstocks for methanol production. ERA

N78-23254# Los Alamos Scientific Lab., N. Mex.

THERMOCHEMICAL PROCESSES FOR HYDROGEN PRODUCTION Progress Report, 1 Jan. - 31 Jul. 1977

Kenneth E. Cox, comp. Oct. 1977 12 p refs

(Contract W-7405-eng-36)

(LA-6970-PR) Avail: NTIS HC A02/MF A01

Schemes to decompose water thermochemically for production of hydrogen were experimentally investigated. Reactions relevant to the sulfuric acid-hydrogen bromide thermochemical cycle were studied along with the use of insoluble bismuth sulfate as a means of concentrating aqueous sulfuric solutions. Preliminary calculations show a significant cycle efficiency increase if solid sulfate and subsequent sulfur trioxide decomposition steps replace the sulfuric acid concentration and decomposition steps proposed in other cycles. ERA

N78-23255# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex.

HYDROGEN GAS FROM CURED RTC SILICONES

L. C. Myers Oct. 1977 10 p

(Contract EY-76-C-04-0789)

(MHSMP-77-60) Avail: NTIS HC A02/MF A01

Eight different RTV silicones were sealed in containers, and after preselected times the amount of hydrogen in the containers was determined. The silicone samples were conditioned at 80 C in a 100% RH air atmosphere and at 23 C in a dry air atmosphere. The amount of gas from duplicate samples varied considerably. The cause of these variations was investigated, and it was determined that humidity in a helium atmosphere produced the maximum hydrogen, and the amount of hydrogen is less if oxygen is present in the atmosphere. ERA

N78-23256# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.

RESULTS OF L-STAR-INSTABILITY EXPERIMENTS WITH DOUBLE BASE ROCKET PROPELLANTS, PART 2

R. S. deBoer, H. F. R. Schoeyer, and H. Wolff Sep. 1977 81 p refs Prepared jointly with Technol. Lab. RVO-TNO, Rijswijk, Neth.

(VTH-LR-252; TL-R-3050-2) Avail: NTIS HC A05/MF A01

Oscillatory combustion experiments to detect the sensitivity of double base rocket propellants to low frequency oscillations are reported. Two regions in the L-star-plane were found where the ARP propellant was apt to oscillate: 0.15 MPa smaller than p(mean) smaller than 0.4 MPa with 0.25 m smaller than L-star smaller than 0.8 m and 1.4 MPa smaller than p(mean) smaller than 4 MPa with 0.25 m smaller than L-star smaller that 1.6 m (L-star = characteristic length of the combustion chamber). No oscillations were observed with the JPN propellant. The effective growth constants were deduced and, postulating various models for damping in the combustion chamber, it was possible to estimate the growth constant of the ARP propellant. Correlation of the response function with p(mean), between p(mean) at oscillation and L-star and between frequency and L-star were found to be weak. Very good correlation was found between frequency and p(mean). ESA

N78-23257# Institut Franco-Allemand de Recherches, St. Louis (France).

THEORETICAL AND EXPERIMENTAL DETERMINATION OF FLOW PROPERTIES INSIDE THE TUBE OF A GUN

R. Heiser (Ernst Mach Inst.), G. Klingenberg (Ernst Mach Inst.), and H. Mach 12 May 1977 15 p refs Presented at the 3d Intern. Symp. on Ballistics, Karlsruhe, West Ger., 23-25 Mar. 1977

(ISL-CO-207/77) Avail: NTIS HC A02/MF A01

This contribution is concerned with the gas dynamic processes occurring in the flow inside the bore of 20 mm caliber guns. Two different interior ballistic models, based upon basic gas dynamic equations are used to compute the in-bore distribution of flow variables by considering different cases of solid propellant motion. The theoretical values obtained depend to some degree upon the analytical model used. In order to corroborate the theoretical treatment, a series of experiments is conducted. Experimentally derived values for projectile velocity, gas pressure, and gas temperature are compared to theoretical predictions. The experiments verify the local increase in temperature toward the base of the moving projectile as predicted by the analysis. From the comparison between theory and experiment conclusions regarding the motion of propellant particles transported by the in-bore gas flow are drawn. Author (ESA)

N78-23258# European Space Agency, Paris (France).

BORON COMBUSTION IN COMBINATORY PROPULSION

A. Boussios Feb. 1978 14 p refs Transl. into ENGLISH of 'Borverbrennung in Kombinationsantrieben', DFVLR, Trauen, West Ger. Report DLR-IB-456-77/8, 1977 Original report in GERMAN previously announced as N78-18229

(ESA-TT-462; DLR-IB-456-77/8) Avail: NTIS HC A02/MF A01

The application of boron to replace kerosine, in combination propulsion systems is discussed. The state of the art of boron as propellant is presented, the influence of N2O4-N2H4-N2 or N2O4-N2H4 as propellant addition is discussed and the energy yield in comparison with ramjet propulsion is considered. ESA

N78-23259# European Space Agency, Paris (France).

INVESTIGATIONS ON THE PRODUCT RELIABILITY OF THE HYDRAZINE DECOMPOSITION CATALYST KC IR 12 GA

W. Hartung and H. Koch Mar. 1978 39 p refs Transl. into ENGLISH of 'Untersuch. zur Produktsicherung des Hydrazinzersetzungskatalysators KC IR 12 GA', DFVLR, Trauen, West Ger. Report DLR-IB-456-77/5, 10 May 1977 Original report in GERMAN previously announced as N78-15298

(ESA-TT-450; DLR-IB-456-77/5) Avail: NTIS HC A03/MF A01

The product equality of charges of the KC IR 12 GA catalyst manufactured at different times was tested. The influence of the manufacturing procedure on the catalyst surface structure was investigated. The relationship between the burning away of the supporting material and the catalyst performance was checked and charge tests were made. The crash test performed in the context of the charge investigations make it clear that the attempts to improve the granular structure of the supporting material by burning were successful. It was proven that the quality of the KC IR 12 GA catalysts produced by the firm Kali-Chemie is constant for different batches. ESA

N78-23260# Propellants, Explosives and Rocket Motor Establishment, Waltham Abbey (England).

MEASUREMENT OF THE VISCOSITY OF PLASTIC PROPELLANT INGREDIENTS BY PARALLEL PLATE PLASTOMETRY

V. M. Gledhill and W. A. Dukes Oct. 1977 24 p refs

(PERME-TR-20; BR59759) Avail: NTIS HC A02/MF A01

The viscosities of three liquids used as ingredients of plastic propellant were measured at room temperature, as a function of the strain rate, by parallel plate plastometry. The liquids were (1) Vistanex LM, a polyisobutene with a falling-sphere viscosity at very low shear rates of about 100 kPa s (1 million poise), (2) a mixture of polyisobutene, plasticizer and surfactants known as PSB, used as the binder for many propellant formulations, and (3) an unplasticized mixture of polyisobutene with surfactants, known as USB, similar to another propellant binder. The strain rate was varied over a range from 0.001 to 1/s, and the measured viscosities ranged from 100 to 1 kPa s (1.000.000 to 10.000 poises). The viscosity of each liquid, within the wide experimental error, was found to be inversely proportional to the square-root of the strain rate at which it was measured. Author (ESA)

N78-23261# Miami Univ., Coral Gables, Fla. Dept. of Mechanical Engineering.

CHARACTERIZATION OF METHANOL/GASOLINE BLENDS AS AUTOMOTIVE FUEL: PERFORMANCE AND EMISSIONS CHARACTERISTICS

R. R. Adt, Jr., K. A. Chester, C. N. Kurucz, J. Pappas, S. Rajan, and M. Swain Jul. 1977 204 p refs
(Contract EPA-R-803401-01-3)
(PB-277135/0; EPA-460/3-77-012a) Avail: NTIS HC A10/MF A01 CSCL 21D

Recent concern about environmental problems and the eventual shortage of conventional petroleum based fuels coupled with the potential of obtaining methyl alcohol (methanol) as a product of coal gasification has brought about a recent interest in the use of methanol as a fuel. In order to assess the feasibility of using methanol as a motor vehicle fuel, either alone (neat) or as a blend in gasoline type base stocks, its performance, emissions and practical use characteristics must be ascertained. A series of experiments was conducted to determine methanol blend fuel engine characteristics information. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N78-23262# Aerospace Engineering Office, Zurich (Switzerland).
STUDY TO EVALUATE SENSITIVITY ANALYSIS ALGORITHMS FOR LOW-COST STRUCTURAL DESIGN AND OPTIMISATION Final Report
R. Spence and K. J. Zimmermann Paris ESA 8 Dec. 1977 78 p refs
(Contract ESTEC-3256/77-NL-PP(SC))
(ESA-CR(P)-1034) Avail: NTIS HC A05/MF A01

The potential applicability to structural analysis and design of existing sensitivity algorithms for electronic circuits, was investigated and described along with their incorporation into structural analysis packages (finite element programs). In general, the algorithms are computationally efficient and, since many assume the availability of the structures Choleski factors, should be capable of incorporation within existing structural analysis packages with little effort. The properties for which algorithms were developed include (1) differential sensitivity of nodal displacements with respect to single and multiple stiffness changes, (2) eigenvector sensitivity, (3) Choleski factor updating, (4) tracking sensitivity, (5) statistical analysis, and (6) single member large change sensitivity. Illustrated applications of the sensitivity algorithms are discussed, and a brief discussion of the analogy between structures and electrical circuits is included. For most of the algorithms very concised (APL) computer programs are presented and illustrated by application to a simple example. Author (ESA)

N78-23263 National Technical Information Service, Springfield, Va.
OFFSHORE PIPELINES. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jan. 1978
Guy E. Habercom, Jr. Mar. 1978 126 p Supersedes NTIS/PS-77/0098
(NTIS/PS-78/0179/8; NTIS/PS-77/0098) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 13J

Citations on construction, utilization, wave action, and environmental aspects of offshore pipelines are presented. Hydrodynamics, benefit costs of underwater pipeline transportation, and risk analysis are among the parameters researched. This updated bibliography contains 121 abstracts. GRA

N78-23264 National Technical Information Service, Springfield, Va.
WIRE ROPE TECHNOLOGY. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jan. 1978
Guy E. Habercom, Jr. Mar. 1978 153 p Supersedes NTIS/PS-77/0100
(NTIS/PS-78/0180/6; NTIS/PS-77/0100) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 01E

The fabrication methods, mechanical properties, and applications for wire rope are investigated. Diversified applications, such as aircraft landing barriers, marine mooring and hoisting devices, highway safety barriers, and balloon tethering are researched. GRA

N78-23265# National Bureau of Standards, Boulder, Colo. Office of the Deputy Director.
COLLECTED EXECUTIVE SUMMARIES: STUDIES OF THE NATIONAL MEASUREMENT SYSTEM, 1972 - 1975
Raymond C. Sangster, ed. Dec. 1977 53 p Revised Supersedes PB-258323
(PB-276494/2; NBSIR-75-947-Rev; PB-258323) Avail: NTIS HC A04/MF A01 CSCL 14B

Documents generated during a three year study of the activities and mechanisms which provide the physical measurement data required in the United States are summarized. Particular emphasis is given to special technical measurement sectors of the society, and to the cost of instrumentation and labor for measurement-related activity in our economy. Topics covered in the executive summaries are: final summary report; direct measurements transactions matrices; economic analysis; structure and functions of measurement system; time and frequency; length and related dimensional measurements; vibration and shock; surface finish; mass volume and density; force; fluid flow; pressure; temperature; humidity and moisture; thermodynamic properties of fluids; cryogenics; electricity; electromagnetics; medical ultrasonics; acoustics; radiometry and photometry; spectrophotometry; far ultraviolet radiometry; optics; physical properties of atoms and molecules; surface properties; ionizing radiation. GRA

N78-23266# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON EASTERN EUROPE: SCIENTIFIC AFFAIRS, NO. 582
10 May 1978 42 p Transl. into ENGLISH from Selected Hungarian and East German Journals
(JPRS-71089) Avail: NTIS HC A03/MF A01

International cooperation in the standardization of measurement and measuring equipment is described as well as the use of computers in public health and research at Hungarian medical schools. For individual title, see N78-23267.

N78-23267# Joint Publications Research Service, Arlington, Va.
GRD ROLE IN CEMA METROLOGY RESEARCH DESCRIBED
Lothar Werner *In its* Transl. on Eastern Europe: Sci. Affairs, No. 582 (JPRS-71089) 10 May 1978 p 1-9 Transl. into ENGLISH from Standardisierung und Qualitaet (East Germany) vol. 24, no. 3, Apr. 1978 p 124-128 (For availability see N78-23266 14-31)
Avail: NTIS HC A03/MF A01

The Standardization, Measurement, and Commodity Testing Office of the German Democratic Republic collaborates with members of the European Committee of Associations of Manufacturers of Machinery (CEMA) in (1) the standardization of physical units and their physical-technical illustration; (2) the development of measurement methods; (3) the formulation of regulations for testing measurement equipment; (4) standardizing measuring instruments; and (5) comparing the highest national norms. Multi-lateral cooperation in bringing CEMA standards up to advanced international level, in working out uniform raw material characteristics, and in obtaining samples of substances and raw materials are described. Agreements for bilateral cooperation with the U.S.S.R. and other CEMA countries for specialization, production engineering, and commodity exchange are discussed, as well as collaboration with international organizations in the field of metrology. A.R.H.

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N78-23268 Iowa State Univ. of Science and Technology, Ames.
A STATISTICAL ANALYSIS OF IONOSPHERIC EFFECTS IN RADIO INTERFEROMETRY Ph.D. Thesis

Ali Okatan 1977 178 p
Avail: Univ. Microfilms Order No. 7805959

The VLBI (Very-Long-Baseline-Interferometry) technique has enormous potential applications in radio astronomy and geodesy. A method to improve the VLBI signal processing is described. The method was based on an adaptive phase noise model and the use of recursive Kalman filter in the time domain. Removing the phase noise from the fringe phase data partially eliminates the bias due to the phase noise. A computer simulation of a recursive prefiltering method was made. In the simulation the signals, assumed to be first order Markov processes were filtered by the use of recursive Kalman filters, then correlated. Through this process the signal to noise ratio of the interferometer was improved significantly. Dissert. Abstr.

N78-23269*# Missouri Univ., Rolla.
DEVELOPMENT AND VERIFICATION OF SIMULATION MODELS FOR ANALYZING ORBITER DIGITAL COMMUNICATION AND DATA LINKS AND ONBOARD MONITORING PARAMETER CORRELATIONS, VOLUME 1 Final Report
William H. Tranter Dec. 1977 28 p
(Contract NAS9-14848)
(NASA-CR-151710; CSR-78-1) Avail: NTIS HC A03/MF A01 CSCL 17B

Digital data system models were developed for use in computer simulation of communication systems and were tested to verify their performance. Postprocessors were developed for determining the noise power in lowpass and bandpass systems. These postprocessors calculated the signal-to-noise ratio at a test node in a system simulation utilizing a user defined reference for the assumed signal. Tests of the postprocessor illustrated that the signal-to-noise ratio is computed to within one db from a signal-to-noise ratio of zero db to over 60 db. The signal-to-noise ratio estimates determined by the postprocessors were mapped into the probability of symbol error for digital data systems. Bit error rates were determined for those systems for which the bit error probability can be analytically related to the predetection signal-to-noise ratio. Author

N78-23270*# Missouri Univ., Rolla. Dept. of Electrical Engineering.
SIGNAL-TO-NOISE RATIO ESTIMATION IN DIGITAL COMPUTER SIMULATION OF LOWPASS AND BANDPASS SYSTEMS WITH APPLICATIONS TO ANALOG AND DIGITAL COMMUNICATIONS, VOLUME 3 Final Report
W. H. Tranter and M. D. Turner Jul. 1977 238 p refs
(Contract NAS9-14848)
(NASA-CR-151712; CSR-77-6-Vol-3) Avail: NTIS HC A11/MF A01 CSCL 17B

Techniques are developed to estimate power gain, delay, signal-to-noise ratio, and mean square error in digital computer simulations of lowpass and bandpass systems. The techniques are applied to analog and digital communications. The signal-to-noise ratio estimates are shown to be maximum likelihood estimates in additive white Gaussian noise. The methods are seen to be especially useful for digital communication systems where the mapping from the signal-to-noise ratio to the error probability can be obtained. Simulation results show the techniques developed to be accurate and quite versatile in evaluating the performance of many systems through digital computer simulation. Author

N78-23271*# Missouri Univ., Rolla.
PHASE-LOCK LOOP MODELS FOR SYSTID SIMULATIONS, VOLUME 4 Final Report
W. H. Tranter and M. D. Turner Jul. 1977 45 p refs
(Contract NAS9-14848)
(NASA-CR-151713; CSR-77-3-Vol-4) Avail: NTIS HC A03/MF A01 CSCL 20N

Phase lock loop models were developed for use in SYSTID simulations, and guidelines for parameter selection were given. Two different models, SOPLL1 and SOPLL2, allow for use with and without a hard limiter at the loop input. Several tests were run to validate loop performance. These include transient response tests, phase error variance tests, and signal to noise ratio tests. These last tests utilize the phase lock loop as an FM discriminator, for which the detection gain was determined for a wide range of signal to noise ratios. All tests illustrate that model performance is satisfactory. Author

N78-23272*# Missouri Univ., Rolla.
SYSTID FOR THE NASA-JSC USER, VOLUME 5 Final Report
W. H. Tranter and A. C. Goris Nov. 1977 43 p ref
(Contract NAS9-14848)
(NASA-CR-151714; CSR-77-7-Vol-5) Avail: NTIS HC A03/MF A01 CSCL 20N

The techniques for executing a SYSTID program in batch mode and demand mode are described. Also included are the instruction sets for adding models to the permanent SYSTID library, updating the directory, updating the SYSTID backup tape and generating a user's manual. Author

N78-23273*# City Coll. of the City Univ. of New York. Communications Systems Lab.
EFFECT OF INTERFERENCE ON DELTA MODULATOR ENCODED VIDEO SIGNALS. DELTA MODULATION ENCODING OF VIDEO SIGNALS Semiannual Report, 1 Oct. 1977 - 30 Apr. 1978. Ph.D. Thesis
Tsu-Leun R. Lei and Donald L. Schilling Apr. 1978 214 p refs
(Grant NsG-5013)
(NASA-CR-156987) Avail: NTIS HC A10/MF A01 CSCL 17B

Multi-dimensional DPCM algorithms were studied for the application of Picturphone. Part of the work which deals with two dimensional intraframe delta modulators are discussed. One dimensional modulators are discussed with the aid of the Abate mode ADM and the Song mode ADM chosen to demonstrate the ability and shortcomings in video signal encoding. Values of the output signal to noise are shown for the objective measurement. The encoded pictures are also shown for the purpose of subjective comparison. Two new types of ADM, the A mode ADM and the B mode ADM are discussed along with frame difference, phase shift, and image distortion etc. Author

N78-23274*# Ball Bros. Research Corp., Boulder, Colo. Aerospace Div.
INTERNATIONAL SUN-EARTH EXPLORER'S MEDIUM GAIN ANTENNA SYSTEM FOR THE A AND C MISSIONS Final Report
J. D. Martinko 18 Apr. 1978 128 p
(Contract NAS5-22466)
(NASA-CR-156753; F78-04) Avail: NTIS HC A07/MF A01 CSCL 20N

Medium gain transmitting antennas designed for International Sun-Earth Satellites A and C are described with emphasis on performance. The gain of both antennas is within 0.5 db of predicted levels. Design modifications in the feed pin assembly and test loads are suggested. J.M.S.

N78-23275*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HIGH-TEMPERATURE MICROPHONE SYSTEM Patent Application
Allan J. Zuckerwar, inventor (to NASA) (Old Dominion Univ. Research Foundation, Norfolk, Va.) Filed 28 Apr. 1978 22 p Sponsored by NASA
(NASA-Case-LAR-12375-1; US-Patent-Appl-SN-900842) Avail: NTIS HC A02/MF A01 CSCL 17B

Apparatus for measuring pressure fluctuations in air or other gases that is suitable for use in areas of elevated temperature is reported. The microphone is modified to decrease the undesirable increase in microphone sensitivity at high temperatures; the connection between the microphone and the carrier electronics is modified to operate as a half-wavelength transmission line and to provide a large temperature gradient between the microphone and carrier electronics; and the carrier electronics is modified by using a voltage controlled oscillator for automatic tuning control thereby permitting control without the addition of capacitors in parallel with the microphone. NASA

N78-23276# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON TELECOMMUNICATIONS POLICY,

RESEARCH AND DEVELOPMENT, NO. 35
28 Apr. 1978 212 p refs Transl. into ENGLISH from World Press and Radio Sources
(JPRS-71028) Avail: NTIS HC A10/MF A01

Translations from the world press and radio relating to worldwide political, economic, and technical developments in telecommunications, computers, and satellite communications are presented. Coverage focused on France, the Federal Republic of Germany, the United Kingdom, Italy, Japan, the USSR, the People's Republic of China, Sweden, and the Netherlands. For individual titles, see N78-23277 through N78-23283.

N78-23277# Joint Publications Research Service, Arlington, Va.
THE COSMOS ALSO INTERESTS US
Jose Altshuler *In its* Transl. on Telecommun. Policy, No. 35 (JPRS-71028) 28 Apr. 1978 p 4-14 Transl. into ENGLISH from Cuba Intern. (Havana), Feb. 1978 p 44-47 (For availability see N78-23276 14-32)
Avail: NTIS HC A10/MF A01

Cuban achievements and prospects in research on outer space and its use for peaceful objectives are reported. Author

N78-23278# Joint Publications Research Service, Arlington, Va.
HORIZON 1990
Michel Lafon *In its* Transl. on Telecommun. Policy, No. 35 (JPRS-71028) 28 Apr. 1978 p 56-68 Transl. into ENGLISH from Rev. Franc. des Telecommun. (Paris), Jan. 1978 p 34-41 (For availability see N78-23276 14-32)
Avail: NTIS HC A10/MF A01

The French telecommunications evolution is discussed centering on improvement and diversification. Author

N78-23279# Joint Publications Research Service, Arlington, Va.
URBAN JUNCTION STATIONS IN RADIO-LINK NETWORKS
C. Colavito and C. Rudilosso *In its* Transl. on Telecommun. Policy, No. 35 (JPRS-71028) 28 Apr. 1978 p 69-89 refs Transl. into ENGLISH from Note, recensioni e Notiz. (Rome), May-Aug. 1975 p 218-244 (For availability see N78-23276 14-32)
Avail: NTIS HC A10/MF A01

From a preliminary examination of the situations that come up in many large urban junction stations, it might seem that at the present time there are intrinsic limitations to the development of radio links due to the restricted radio frequency spectrum available and to the interaction between the use of the spectrum and the urban structures themselves. A demonstration of how suitable measures make it possible to confront apparent saturation situations determined by local factors such as the presence of reradiating obstacles is presented. The advantages and disadvantages of two solutions were examined, mainly taking into account the requirement that the radio spectrum be used as much as possible without noticeably detracting from the quality and availability of the connections. Author

N78-23280# Joint Publications Research Service, Arlington, Va.
PERFORMANCE OF PHOTODETECTOR FOR OPTICAL COMMUNICATION SYSTEMS
B. Daino and F. Lombardi *In its* Transl. on Telecommun. Policy, No. 35 (JPRS-71028) 28 Apr. 1978 p 90-101 refs Transl. into ENGLISH from Note, Recensioni e Notiz. (Rome), Jan.-Apr. 1976 p 93-104 (For availability see N78-23276 14-32)
Avail: NTIS HC A10/MF A01

In order to define the possible features of a TLC/FO system it is necessary to pinpoint the causes that limit its capacity for information. The limits placed on the features of the detector as far as the bandpass and the useful power on the load are concerned are reported. Author

N78-23281# Joint Publications Research Service, Arlington, Va.
DESIGN CRITERIA OF TERRESTRIAL TELECOMMUNICATION SYSTEMS ABOVE 10 GHz
F. Fedi, R. Koch, and B. Peroni *In its* Transl. on Telecommun. Policy, No. 35 (JPRS-71028) 28 Apr. 1978 p 102-135 refs Transl. into ENGLISH from Note, Recensioni e Notiz. (Rome), Jan.-Apr. 1975 p 33-69 (For availability see N78-23276 14-32)
Avail: NTIS HC A10/MF A01

The Bordoni proposed studies on the conditions for free propagation of electromagnetic waves at frequencies above 10 gigahertz and on the influence exerted by atmospheric precipitation on their spacetime structure are presented. Author

N78-23282# Joint Publications Research Service, Arlington, Va.
RAINFALL RATE WITHIN ISPT-FUB RESEARCH ON RADIOPROPAGATION ABOVE 10 GHz
F. Fedi, U. Merlo, and B. Peroni *In its* Transl. on Telecommun. Policy, No. 35 (JPRS-71028) 28 Apr. 1978 p 136-187 Transl. into ENGLISH from Note, Recensioni e Notiz. (Rome), Jan.-Apr. 1975 p 70-120 (For availability see N78-23276 14-32)
Avail: NTIS HC A10/MF A01

A description of the measurement results on a sampling of the capacitor type rain gages obtained in order to determine whether their features match various objectives for which the measurements received by these rain gages are intended is presented. Author

N78-23283# Joint Publications Research Service, Arlington, Va.
FUNDAMENTAL PRINCIPLES OF THE INTEGRATED TELECOMMUNICATIONS SYSTEM (IFS)
Walter Suter *In its* Transl. on Telecommun. Policy, No. 35 (JPRS-71028) 28 Apr. 1978 p 188-206 refs Transl. into ENGLISH from Tech. Mitt. (Bern), no. 9, 1977 p 398-410 (For availability see N78-23276 14-32)
Avail: NTIS HC A10/MF A01

In addition to the boundary conditions characterizing the system design, the following are also described; (1) general structure of net; (2) safety provisions; (3) principles of command information exchange; and (4) the communication process.
Author

N78-23284# California Univ., Los Angeles. Dept. of System Sciences.
ALGORITHMS FOR THREE AND FOUR DIMENSIONAL GEOMETRICAL MOMENT SPACE BOUNDING
M. A. King, Jr. and K. Yao Feb. 1978 79 p refs
(Contract N00014-76-C-0875)
(AD-A052150; UCLA-ENG-7806) Avail: NTIS HC A05/MF A01 CSCL 17/2

The solution to many problems in communication theory takes the form of a moment of a function of a random variable. Often this moment is difficult to evaluate numerically. When this is the case, tight bounds to the true value are sought that are relatively easy to evaluate. One method of deriving such bounds is a geometrical technique that is a result of an Isomorphism Theorem from Game Theory. Recently, very useful bounds have been derived with this technique using two and some classes of three-dimensional geometries. All of these results have been analytical in nature. This report extends this work by providing algorithmic techniques for evaluating bounds produced by all classes of three and four-dimensional geometries. In addition, a procedure for extending these algorithms to problems of dimensionality greater than four is outlined. Implementations of the three and four-dimensional algorithms are presented in appendices. Author (GRA)

N78-23285# Arinc Research Corp., Annapolis, Md.
A STUDY OF THE ECONOMIC IMPACT OF SELECTED COMMUNICATIONS ALTERNATIVES, PRESENT SYSTEM DEFINITION
P. Woodie and W. Kolb Mar. 1978 48 p refs
(Contract DOT-FAA77WA-4018)
(AD-A052162; Rept-1339-01-1-1723) Avail: NTIS HC A03/MF A01 CSCL 17/2

This report provides a description of the present FAA communications system. The data base described herein will be incorporated in a communications cost model being developed for the Federal Aviation Administration (FAA) by ARINC Research Corporation. The economic data presented were obtained primarily from three sources: (1) the Aviation Cost Allocation Study Working

Paper No. 2 (Office of Policy Review, DOT, 1972) for one-time facilities and equipment (F and E) costs; (2) the Airways Facilities Maintenance Cost Study (Project Memorandum: PPA FP-604, 1976) for operation and maintenance (O and M) costs; and (3) the DECCO Circuit File for recurring leased costs. Defining such a comprehensive communications cost data base was complicated by the fact that there is no clear definition within the FAA of what constitutes communications. For the purposes of the present cost-modeling effort, however, it is convenient to classify costs into two groups: (1) traditional FAA communications services, including Air/Ground, Ground/Ground, Remote Link, Weather Net, AFTN, Service B, Computer B, and a miscellaneous category of additional communications functions; and (2) services in which some (incidental) communications is required for the functioning of basic FAA systems, viz., air traffic control, surveillance, and navigation. GRA

N78-23286# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DESIGN OF OPTIMUM TWO-MIRROR ANTENNAS WITH THE OSCILLATION OF RADIATION PATTERN
G. K. Galimov 1 Dec. 1977 205 p refs Transl. into ENGLISH of mono. "Proyektirovaniye Optimalnykh Dvukhzer Kalnykh Antenns Kachaniyem Diagrammy Napravlennosti", Moscow, 1969 p 11-121
(AD-A051949; FTD-ID(RS)T-2008-77) Avail: NTIS HC A10/MF A01 CSCL 09/5

Aplanatic antennas were developed for the parallel region of infinitely thin systems. General methods were evaluated for the construction of antennas to optimally solve the problem of astigmatism. A unified theory of optimum scanning antennas was developed involving both formulation of general problems and procedures for solving such problems. P.R.A.

N78-23287# Air Force Weapons Lab., Kirtland AFB, N. Mex.
THE PROPAGATION OF SATELLITE SIGNALS THROUGH TURBULENT MEDIA Final Report
Leon A. Wittwer Jan. 1978 477 p refs
(AD-A051932; AFWL-TR-77-183) Avail: NTIS HC A21/MF A01 CSCL 17/2

Calculations of the effects of striated ionospheres on satellite signals are presented and analyzed. The calculations include the effects of various striation power spectral densities and scale sizes. All types of propagation cases that are reasonably expected are included. Author (GRA)

N78-23288# Swedlow, Inc., Garden Grove, Calif
MANUFACTURING METHODS AND TECHNOLOGY PROJECT TO ESTABLISH PRODUCTION TECHNIQUES TO MANUFACTURE RIGID ARMOR FOR RADAR ANTENNA HARDENING Quarterly Report, 1 Jun. - 31 Aug. 1977
R. Doerr Jan. 1977 44 p refs
(Contract DAAB07-77-C-0476)
(AD-A051695; SI-ER-915; QR-1) Avail: NTIS HC A03/MF A01 CSCL 19/4

Manufacturing methods and technology to establish production techniques for fabrication of stretched, oriented, polypropylene film armor that is both RF transparent and fragment resistant are to be developed. Prototype processing technology and evaluation procedures developed by the Army Materials and Mechanics Research Center are to be revised for use in production facilities with mass production equipment. Radome panels are to be constructed to demonstrate the mass production capabilities, confirm production rates, and establish mass production plans to meet estimated military needs. The project is to consist of preliminary sample panel fabrication to confirm physical and electrical characteristics, a pilot production run to confirm production rates, and an in-plant demonstration of production capabilities. Reports are to be provided on all phases of production development through the pilot run. In addition, production studies and planning necessary for expansion to a mass production basis are to be provided. Author (GRA)

N78-23289# California Univ., Irvine. Dept. of Physics.
THE INTERACTION OF ELECTROMAGNETIC RADIATION WITH SOLID MATERIALS Final Report, 1 Sep. 1975 - 31 Dec. 1977
A. A. Maradudin and D. L. Mills 31 Dec. 1977 26 p refs
(Grant AF-AFOSR-2887-76; AF Proj. 2306)
(AD-A051862; AFOSR-78-0431TR) Avail: NTIS HC A03/MF A01 CSCL 10/14

Theoretical research has been completed in four areas of study and analysis of the interaction of electromagnetic radiation with solids: Surface and Size Effects on the Excitation Spectra of Solids, and on the Interaction of Electromagnetic Radiation with Crystals from Microwave through Visible Frequencies; Surface Wave Propagation at Microwave Frequencies; Rayleigh Waves (Surface Acoustic Waves); Theory of Wave Propagation on Nonplanar Surfaces; Edge Modes, Rounded Corners and Topographic Waveguides; and Optical Interactions in Impure and Disordered Solids. Author (GRA)

N78-23290# Naval Postgraduate School, Monterey, Calif.
ITU REGISTRATIONS AND NAVY UHF SATCOM
Timothy D. B. Meno and John E. Ohlson Oct. 1976 174 p refs
(AD-A052071; NPS-620L76104) Avail: NTIS HC A05/MF A01 CSCL 17/2

This report examines international frequency management as applied to the 225-400 and 500-890 MHz UHF bands. The 40,647 registrations from the 1975 International Frequency List were analyzed in terms of four characteristics: frequency, location, power level, and maximum hours of operation. A relationship between registrations and national interest is suggested, and 10 countries are identified that account for 84.3 percent of registrations in the 225-400 MHz band. Ten countries are also identified that account for 96.4 percent of registrations in the 500-890 MHz band. Seventy percent of transmitters registered in the 225-400 MHz band have power levels of 100 watts or greater, while in the 500-890 MHz band, only 35 percent operate at this level. Intermittent operation dominates the 225-400 MHz band; registrations indicating 24-hour continuous operation dominate the 500-890 MHz band. These findings have implications in terms of potential interference between terrestrial users and current and future Navy SATCOM operations. Author (GRA)

N78-23291# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROPAGATION OF ELECTROMAGNETIC WAVES IN PARAMETRIC MEDIA IN THE APPROXIMATION OF GEOMETRIC OPTICS
V. N. Krasilnikov 22 Dec. 1977 30 p refs Transl. into ENGLISH from Probl. Difrakskii i Rasprostraneniya Voln (Leningrad), no. 5 1966 p 76-88
(AD-A051980; FTD-ID(RS)T-2184-77) Avail: NTIS HC A03/MF A01 CSCL 20/4

During the passage of waves through media whose parameters are changed in time (subsequently let us call them simply parametric), occur special effects, for example a change in the spectral composition of signal. Therefore to their study traditional approach proves to be inapplicable, and is required special examination, in order to explain the possibility of using the laws of geometric optics. In this case, systematically it is more justified to analyze directly the equations of Maxwell, but not to reduce them for different special cases to one differential equation for certain scalar function, as this frequently is done. Since the approximation of geometric optics does not fit the description of fields in the vicinity of their sources, the usual formulation of the problem of geometric approximation consists of finding the wave process of space, if the value of field on certain initial surface S(o) is known. The latter can be selected in the wave zone of an emitter. It can pass in those regions of space where there is still no perturbation action of heterogeneous and parametric properties of the medium. Surface S(o) is convenient to combine with the position of the wave front (in monochromatic field this is the constant-phase surface). GRA

N78-23292# Megatek Corp., San Diego, Calif.
MINIMUF-3: A SIMPLIFIED HF MUF PREDICTION ALGORITHM Final Report, Oct. 1976 - Sep. 1977
R. B. Rose, J. N. Martin, and P. H. Levine 1 Feb. 1978 53 p refs
(Contract N00123-75-C-0328)
(AD-A052052; NOSC-TR-186) Avail: NTIS HC A04/MF A01 CSCL 17/2

MINIMUF-3 is a semiempirical model for predicting the

maximum usable frequency (MUF) for hf propagation. It was designed to allow simplified hf propagation predictions to be performed in a near real time mobile, tactical environment. An 80 statement BASIC language subroutine is presented which outputs MUF for arbitrary input values of receiver/transmission position, month, date, time (UT), and solar sunspot number. The program is compatible with existing and newly emerging generations of mini- and microprocessor-based computers. Results of extensive tests comparing MINIMUF-3 against hf oblique sounder data are also presented. The sounder data encompassed 196 path months (4704 test points) of observed MOFS from 23 different hf transmission paths. The overall rms residual error of MINIMUF-3 was 3.83 MHz. The results compared favorably with those obtained from large-scale hf prediction codes that were exercised against the same sounder data set.

Author (GRA)

N78-23293# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.

SOURCE CODING FOR COMMUNICATION CONCENTRATORS Ph.D. Thesis

Pierre Amedee Humblet Jan. 1978 217 p refs

(Contract N00014-75-C-1183; ARPA Order 3045)

(AD-A051166; ESL-R-798) Avail: NTIS HC A10/MF A01 CSCL 17/2

Communication concentrators perform the basic network function of merging many input flows into a single output flow. This requires formating the data and encoding side information about when messages start, what their lengths are and what their origins and destinations are. This thesis examines efficient ways of performing these functions, the objective being to minimize the average message delay, or some other queueing theoretic quantity, like the probability of buffer overflow. The work is divided in four parts; (1) encoding of the data; (2) encoding of message lengths; (3) encoding of message starting times; (4) encoding of message origins and destinations. With respect to data encoding, an algorithm is given to construct a prefix condition code that minimizes the probability of buffer overflow. Next a theory of variable length flags is developed and applied to the encoding of message lengths. For concentrators with synchronous output streams, it is shown that the concept of average number of protocol bits per message is meaningless. Thus, in order to analyze the encoding of message starting times, a class of flag strategies is considered in which there is a tradeoff between delay and low priority traffic. GRA

N78-23294# Rome Air Development Center, Griffiss AFB, N.Y.

ANALYSIS OF THE MICROSTRIP DISK ANTENNA ELEMENT

Anders Derneryd Nov. 1977 27 p refs

(AD-A051187; RADC-TR-77-383) Avail: NTIS HC A03/MF A01 CSCL 09/5

The circular microstrip antenna element is formed by a radiating disk closely spaced above a groundplane. It is modeled as a cylindrical cavity with magnetic walls that can be resonant in the TM modes. The far-fields and the radiation conductances for different mode structures have been calculated assuming a magnetic line current flowing around the perimeter of the disk. The directivity of the disk antenna excited in the dominant mode is between 4.8 db and 9.9 db, depending on the size. Losses, due to imperfect supporting dielectric and due to finite conductivity of the conductors, have been derived by means of a perturbation technique assuming small losses don't drastically change the fields from their loss-free case. Graphs are given for design purposes showing the input impedance, the Q-factor, and the radiation efficiency at resonance for different modes and spacings. The air-filled microstrip antenna has the highest efficiency and the broadest bandwidth for a given frequency. Author (GRA)

N78-23295# Rome Air Development Center, Griffiss AFB, N.Y.

MEASURED BACKSCATTER MODULATION FROM LINEARLY OSCILLATING METAL DISKS

Richard B. Mack Aug. 1977 26 p refs

(AF Proj. 2305)

(AD-A051189; RADC-TR-77-285) Avail: NTIS HC A03/MF A01 CSCL 17/4

The work described in this report was carried out as part of the basic research program directed toward providing an understanding of the radar detection of agitated metals (RADAM). The report describes an experimental equipment and measurement procedure that permits determination of the kind and amount of modulation introduced onto the backscattered electromagnetic signal by a vibrating or oscillating scattering target. Although discussed specifically in terms of equipment realization at 10 GHz, the techniques are general. Provision has been included for determining characteristics of the mechanical motion and correlating mechanical and electromagnetic results in the time and frequency domain. The results of a series of measurements of modulated backscatter cross sections due to a disk executing small rigid translational oscillations show the modulation introduced to be all phase modulation; measured results are in good agreement with those calculated from a soundly-based theory. In addition, it is shown that the modulation amplitude is independent of modulation frequency, that the phase modulation introduced is directly proportional to the amplitude of the mechanical oscillation, and that the spectral components of the modulated signal are monotonically decreasing for simple sinusoidal motion. Author (GRA)

N78-23296# Rome Air Development Center, Griffiss AFB, N.Y.

EFFECT OF FRESNEL ZONE BLOCKAGE ON VERY LOW SIDELOBE ANTENNAS

Ronald L. Fante Oct. 1977 20 p refs

(AF Proj. 2305)

(AD-A051188; RADC-TR-77-361) Avail: NTIS HC A02/MF A01 CSCL 17/4

Silver's method for estimating antenna sidelobes owing to blockage is accurate only for obstacles in the near field; it is unduly pessimistic for obstacles elsewhere in the Fresnel zone. A method for calculating the sidelobe level in the latter case is presented and applied to some problems that are typical as well as practical. Author (GRA)

N78-23297# Research Triangle Inst., Research Triangle Park, N. C.

MICROPROCESSING TECHNIQUES FOR ADVANCED SENSORS APPLICATIONS

Larry B. Owen (Army Missile R and D Command) and James B. Clary Redstone Arsenal, Ala. Army Missile R and D Command 31 Sep. 1977 65 p refs Prepared for Battelle Columbus Labs., Durham, N. C.

(Contract DAAG29-76-D-0100; DA Proj. 1M3-62303-A-214)

(AD-A051247; RTI-43U-1408; DRDM-T-78-25) Avail: NTIS HC A04/MF A01 CSCL 09/2

The objective of this study is to investigate the use of microprocessors and other currently available large scale integrated circuitry for radar signal processing application. Several signal processing algorithms were simulated using candidate processing architectures. Performance comparisons are presented. A recommended design using 'task allocated' processors is shown to provide the required speed and performance necessary.

Author (GRA)

N78-23298# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SPECTRAL ANALYSIS OF THE ENVELOPE OF AN AMPLITUDE-MODULATED SIGNAL AT THE OUTPUT OF AN AMPLIFIER WITH A LOGARITHMIC AMPLITUDE CHARACTERISTIC

A. A. Voronin and A. G. Gordiyenko 26 Sep. 1977 12 p refs Transl. into ENGLISH from Radiotekhnika (USSR), no. 21, 1972 p 15-17

(AD-A051590; FTD-ID(RS)T-1678-77) Avail: NTIS HC A02/MF A01 CSCL 09/5

Spectral analysis of the envelope of an amplitude-modulated signal at the output of an amplifier with a logarithmic amplitude characteristic. GRA

N78-23299# Culler/Harrison, Inc., Goleta, Calif.

SPEECH COMPRESSION PROTOTYPE DEVELOPMENT Final Technical Report, May - Dec. 1977

Judith Bruckner and Michael McCammon Dec. 1977 15 p refs

(Contract MDA903-77-C-0220; ARPA Order 3402)

(AD-A051607; CHI-FIN-001) Avail: NTIS HC A02/MF A01 CSCL 17/2

This report covers work performed by Culler/Harrison, Inc. (CHI) under contract no. MDA903-77-C-0220 for the period May 1, 1977 to December 31, 1977. During this period, Culler/Harrison, Inc. has analyzed trace recordings of network voice conferences to determine the nature of delays and range of variations in network transit time, and implemented an automatic delay adjustment algorithm to enhance reproductive quality. Author (GRA)

N78-23300# National Bureau of Standards, Washington, D. C. Inst. for Basic Standards.

SOME ac TRANSMISSION LINE FIELD MEASUREMENTS

F. R. Kotter and M. Misakian Nov. 1977 79 p refs
(Contract EA-77-A-01-6010)
(HCP/T6010-E1) Avail: NTIS HC A05/MF A01

The concern in recent years over the environmental effects of electric and magnetic fields from high voltage transmission lines has also focused attention on the accuracy of measurements of these fields. Electric field meters are discussed in terms of theory of operation, parameters affecting performance, meter performance under field and laboratory conditions, and calibration procedures. The performance and calibration of magnetic field meters are described. Author (ERA)

N78-23301# Helsinki Univ. of Technology, Espoo (Finland). Radio Lab.

[ACTIVITIES OF THE RADIO LABORATORY AND ITS METSAEHOVI RADIO RESEARCH STATION] Annual Report, Aug. 1975 - Dec. 1976

Martti Tiuri, ed. 1977 39 p refs
(Rept-S-96; ISBN-951-751-042-X) Avail: NTIS HC A03/MF A01

Activities in the following areas are reported: electromagnetic theory and techniques; microwave applications; circuit theory and computer aided design; radio science research and instrumentation. Staff and publications are listed. ESA

N78-23302# AEG-Telefunken, Ulm (West Germany).

A CCD MEMORY CHIP FOR RADAR IMAGE PROCESSING

K. Roedde, E. Stein, and H.-J. Wulf [1976] 7 p refs Sponsored by Federal Min. of Res. and Technol.
Avail: NTIS HC A02/MF A01

Considerations for the design of a digital Charge Coupled Devices (CCD) memory will be discussed. Starting from commercial CCD, the design characteristics of a second generation CCD will be derived. The economically feasible capacity and its dependency on the technology lead to the definition of performance parameters and the chip organization. A Serial-Parallel-Serial (SPS) organization will be found most suitable and design considerations of SPS blocks will be discussed. Finally, the overall design of a 32 kbit CCD will be described. Author (ESA)

N78-23303# Technical Univ. of Denmark, Lyngby. Lab. of Electromagnetic Theory.

COMPARISON BETWEEN EXPERIMENTAL AND THEORETICAL PATTERNS FOR ANTENNAS MOUNTED ON SIMPLE SATELLITE MODELS, PART 1

Henning Bach and Knud Pontoppidan Paris ESA Apr. 1977 16 p refs 2 Vol.
(Contract ESTEC-2866/76)
(TUD-R-181; ESA-CR(P)-1027-Pt-1) Avail: NTIS HC A02/MF A01

Measured and computed high frequency satellite antenna radiation patterns for simple satellite models were compared and critically evaluated. For the experiments the box, circular, and prism satellite models were chosen. Two short dipole antennas, a simple quarter wave monopole and a double Bazooka antenna, were used. The theoretical patterns were obtained with the polyhedral satellite subroutine package (PSSV) and with the finite circular cylinder subroutine package (FCCSP). The patterns are compiled in part 2 of this report. ESA

N78-23304# Technical Univ. of Denmark, Lyngby. Lab. of Electromagnetic Theory.

COMPARISON BETWEEN EXPERIMENTAL AND THEORETICAL PATTERNS FOR ANTENNAS MOUNTED ON SIMPLE SATELLITE MODELS, PART 2

Henning Bach Paris ESA Apr. 1977 118 p 2 Vol.
(Contract ESTEC-2866/76)
(TUD-R-181; ESA-CR(P)-1027-Pt-2) Avail: NTIS HC A06/MF A01

For abstract, see N78-23303.

N78-23305# Technical Univ. of Denmark, Lyngby. Lab. of Electromagnetic Theory.

RADIATION PATTERN PREDICTION FOR HIGH FREQUENCY ANTENNAS Final Report

N. C. Albertsen (TICRA ApS, Copenhagen), H. Bach, P. Balling (TICRA ApS, Copenhagen), O. Soerensen, and K. Pontoppidan (TICRA ApS, Copenhagen) Paris ESA Jun. 1977 64 p refs
(Contract ESTEC-2866/76)
(TUD-R-183; ESA-CR(P)-1028) Avail: NTIS HC A04/MF A01

Geometric theory of diffraction (GTD) computer programs for the computation of high frequency antenna radiation patterns were refined to include slope diffraction. Further improvements, such as inclusion of vortex diffraction and a refined ray tracing procedure, were made. Some special theoretical and numerical investigations were carried out. ESA

N78-23306# Technical Univ. of Denmark, Lyngby. Lab. of Electromagnetic Theory.

STUDY AND DEVELOPMENT OF NEAR-FIELD TEST METHODS FOR ANTENNAS Final Report

H. Bach, E. LintzChristensen, J. Hansen, Frank Jensen (TICRA ApS, Copenhagen), F. H. Larsen, O. Soerensen, and J. Voldby Paris ESA 10 Jan. 1978 192 p refs
(Contract ESTEC-2955/76-AK)
(TUD-R-194; ESA-CR(P)-1032) Avail: NTIS HC A09/MF A01

An experimental facility for near field testing of spacecraft antennas was planned. The facility is foreseen for the study and development of the so-called spherical test technique in which the radiation from the antenna under test is measured on a spherical surface in its near field. The associated radiation pattern of the test antenna is subsequently found by transforming the near field data by the use of a computer. A series of investigations was carried out as a first step towards implementation of the planned experimental facility in the Radio Anechoic Chamber of the Technical University of Denmark. Design and construction of certain critical hardware items for the precise alignment and rotation of the test antenna were made. A data collecting and controlling system was specified to a level permitting budgets to be worked out. Computer simulation studies of the influence of inaccuracies in the mechanical or electrical systems performing the near field measurements were made. Author (ESA)

N78-23307# European Space Research and Technology Center, Noordwijk (Netherlands).

AEROSAT COMMUNICATION MANAGEMENT

J. Louet 18 Oct. 1977 20 p Presented at the Intern. Conf. on Electron. Systems and Navigation Aids, Paris, 14-18 Nov. 1977
Avail: NTIS HC A02/MF A01

Work done by the participants in the Aerosat program is reported, relating to services to be provided, the communication management proposed, and an analysis of the potential capabilities of the system. The design of the common system was checked by fast time simulations, and it was shown to be not only capable of handling the message traffic envisaged but also flexible and relatively insensitive to wide variations of this traffic. ESA

N78-23308# Royal Signals and Radar Establishment, Christchurch (England).

WIREGRID PROGRAM FOR ANTENNA MODELLING INCLUDING SINUSOIDAL INTERPOLATION OF CURRENT

T. Benjamin May 1977 46 p refs
(RSRE-77014; BR58801) Avail: NTIS HC A03/MF A01

A method for computer modelling of aerial systems, especially aerials mounted on vehicles is described. It is based on the wiregrid modelling technique and uses a variation known as sinusoidal interpolation to represent the current in the wires of the model. Results are included for some preliminary test runs of the program, comparing them with standard results and the output of other modelling programs. Author (ESA)

N78-23309# Royal Signals and Radar Establishment, Christchurch (England).
EFFECTS OF TREES AND FOLIAGE ON THE PROPAGATION OF UHF SATELLITE SIGNALS
M. J. Downey May 1977 39 p refs
(RSRE-77017; BR59202) Avail: NTIS HC A03/MF A01

Measurements of the extra attenuation of UHF satellite signals due to siting of the receiver equipment within woods in Southern England are presented. The results are summarized as probability distributions. At 254 MHz the average loss was 8 db. The effects due to undergrowth and soil surface were minimal.Author (ESA)

N78-23310# European Space Agency, Paris (France).
THE GEOMETRICAL THEORY OF DIFFRACTION - A METHOD FOR THE SOLUTION OF ELECTROMAGNETIC BOUNDARY PROBLEMS OF COMPLICATED STRUCTURES IN THE HIGH FREQUENCY CASE
A. Schrott Apr. 1978 251 p refs Transl. into ENGLISH of 'Die geometrische Beugungstheorie - Ein Verfahren zur Loesung elektromagnetischer Randwertprobl. bei komplizierten Strukturen im Hochfrequenzfall', DFVLR, Oberpfaffenhofen, West Ger. Report, 1977 Original report in GERMAN previously announced as N78-18290
(ESA-TT-435) Avail: NTIS HC A12/MF A01

Determination of the radiation characteristic of antennas on complicated structures, such as satellites and aircraft, and the scattering at these structures in the high frequency case with the aid of the geometrical theory of diffraction is dealt with. The complicated structures are divided into canonical forms, which can be analyzed by rigorous asymptotic methods. The most important canonical problems like the diffraction at an edge are treated extensively. The diffraction coefficients for the computation of the diffracted field are presented. Ray tracing is carried out for several structures. The computation of the field at caustics with the aid of equivalent edge currents or correction factors respectively is discussed in detail. The field of application and the accuracy of the geometrical theory of diffraction is demonstrated with numerous computational examples. Author (ESA)

N78-23311# European Space Agency, Paris (France).
THE INTEGRAL EQUATION METHOD - A COMPUTATIONAL METHOD FOR DIFFRACTED AND SCATTERED FIELDS OF COMPLICATED STRUCTURES
V. Stein Apr. 1978 215 p refs Transl. into ENGLISH of 'Die Integralgleichungsmethode - ein Verfahren zur Berechnung der Beugungs- u. Streufelder komplizierter Koerper', DFVLR, Oberpfaffenhofen, West Ger. Report, 1977 Original report in GERMAN previously announced as N78-18291
(ESA-TT-436) Avail: NTIS HC A10/MF A01

Determination of the radiation and scattering behavior of complicated structures with the aid of the integral equation method is dealt with. These structures may be complicated isolated radiators or shapes like helicopters or satellites, which are excited by an electromagnetic wave. The real structure is substituted by a mathematical model for the solution of the electric and magnetic field integral equations by means of the method of moments. In order to reduce the computer storage requirements special procedures such as the numerical Green function are used. The combination of both integral equations for the investigation of special problems like the resonance case is discussed in some detail. The field of application and the accuracy of the integral equation method are demonstrated with numerous computational examples. Author (ESA)

N78-23312# Texas Instruments, Inc., Dallas. Central Research Labs.
HIGH PERFORMANCE TV RECEIVER Final Report
D. L. Ash and C. S. Hartmann Nov. 1977 131 p refs
(Contract FCC-0206-6TQ)
(PB-277186/3; FCC/OCE/CF-78/01) Avail: NTIS HC A07/MF A01 CSCL 17B

A surface acoustic wave device and circuit technologies were used to improve the rejection of interfering signals by a television receiver. Components of the system, which would not involve a major retail price increase, are described. Circuit diagrams are included. The primary benefit would be to allow much closer TV channel assignment and hence, improved spectrum utilization, particularly for UHF TV where current assignment rules prohibit the use of 18 other channels every time a single UHF channel assignment is made. GRA

N78-23313# Federal Communications Commission, Washington, D. C. Spectrum Allocations Div.
SURVEY OF THE NON-GOVERNMENT MASTER FREQUENCY FILE
Phillip G. Tremper Jan. 1978 64 p refs
(PB-276376/1; FCC/OCE/SA-78/01) Avail. NTIS HC A04/MF A01 CSCL 17B

Random samples were taken from the Safety and Special Radio Services Bureau paper data base (PDB) and compared to records stored in the master frequency file (MFF). Random samples were then taken from the MFF and compared to the licenses stored in the PDB. The surveys demonstrated the percentage completeness of the two data bases and the percent accuracy of each data element within the MFF. Recommendations are given to improve the utility of the MFF and its accuracy for use in frequency assignment. GRA

N78-23314# Federal Communications Commission, Washington, D. C. Lab Div.
A STUDY OF THE CHARACTERISTICS OF THE FCC PROTOTYPE TV RECEIVER RELATIVE TO CONVENTIONAL RECEIVER UHF TABOOS
L. C. Middlekamp, H. Davis, and C. R. Weber Feb. 1978 38 p
(FCC Proj. 2229-72)
(PB-277187/1; FCC/OCE/LAB-78/01) Avail: NTIS HC A03/MF A01 CSCL 17B

The FCC prototype receiver employs an unconventional IF system (dual-conversion) and unique circuitry from RF input through detector output. Tests made on the receiver with UHF television channel combinations which create interference effects in conventional TV receivers are described. Comparisons of the prototype's performance with that of the conventional receivers are given as well as an evaluation with respect to requested (FCC) and projected (TI) performance. GRA

N78-23315# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
A DIRECT APPROACH TO THE DERIVATION OF ELECTRIC DYADIC GREEN'S FUNCTION
Arthur D. Yaghjian Jan. 1978 70 p refs
(PB-277171/5; NBS-TN-1000) Avail: NTIS HC A04/MF A01 CSCL 20C

A straightforward approach that does not require delta function techniques was used to derive a generalized electric dyadic Green's function which remains valid within the source region. Although the electric field expressed by the dyadic Green's function proves to be unique, the exact form of the dyadic itself depends, in the source regions, upon the geometry of its principal volume. The dependence on principal volume was determined explicitly. Moreover, delta-function techniques, which by themselves were shown to be inadequate to extract uniquely the proper electric dyadic Green's function in the source region, can be supplemented by a very simple procedure to yield unambiguously the correct Green's function and associated fields. GRA

N78-23316 National Technical Information Service, Springfield, Va.
TELECONFERENCING. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jan. 1978
William E. Reed Mar. 1978 67 p
(NTIS/PS-78/0177/2) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 17B

Research is cited on the procedure, use, and evaluation of teleconferencing systems. Subjects include human factors, decision making, public services, use of computer networks, speech compression, digital systems, energy conservation, and substitute for travel. GRA

N78-23317# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
ERROR EQUATIONS USED IN THE NBS EARTH TERMINAL MEASUREMENT SYSTEM
William C. Daywitt Dec. 1977 32 p refs
(PB-276253/2; NBSIR-78-869) Avail: NTIS

HC A03/MF A01 CSCL 17B

The derivation of equations employed in a measurement and error analysis of satellite EIRP (effective isotropic radiated power), using a calibrated radio star, is presented. A table showing analysis results at 7.55 GHz using Cassiopeia A for a satellite at 12 degrees elevation angle is given. The quadrature sum of the systematic errors appearing in the table is 10.1%. Also presented is a curve of the systematic errors as a function of elevation angle showing a 7.3% minimum at high elevation angles. Working equations for the calculation of correction and errors are included. GRA

N78-23318# Advisory Group for Aerospace Research and Development, Paris (France).

RECENT ADVANCES IN RADIO AND OPTICAL PROPAGATION FOR MODERN COMMUNICATIONS, NAVIGATION AND DETECTION SYSTEMS

Apr. 1978 270 p refs

(AGARD-LS-93; ISBN-92-835-1280-4) Copyright. Avail: NTIS HC A12/MF A01

Ionospheric limitations and tropospheric effects which contribute to radio wave propagation problems are introduced, as well as the problems of coherent propagation and image reconstruction, incoherent propagation, and remote sensing, in optical systems. Other topics discussed include transmission-radiation difficulties, blooming, and LIDAR; incoherent optical propagation; effects of atmospheric properties, surface signatures, and the sea on infrared, ultraviolet, and microwave remote sensing; and radio wave scintillation effects on tracking and communication. For individual titles, see N78-23319 through N78-23330.

N78-23319# Forschungsinstitut fuer Optik, Tuebingen (West Germany).

INTRODUCTION TO OPTICAL PROBLEMS OF SYSTEMS

Dieter H. Hoehn *In* AGARD Recent Advan. in Radio and Opt. Propagation for Mod. Commun., Navigation and Detection Systems Apr. 1978 8 p refs (For availability see N78-23318 14-32) Avail: NTIS HC A12/MF A01

The effects of atmospheric optical propagation on modern optical/optronical systems, as used for communications, navigation, and detection are discussed. With respect to the different types of systems (passive-active, imaging-nonimaging, coherent-incoherent) basic environmental effects, especially related to propagation are summarized, as affecting the general modules background target and propagation medium. These effects are related to the relevant atmospheric constituents. Meteorological aspects, e.g. the probability of certain propagation conditions or forecasting problems, are identified as essential for armament development and especially for the effective application of systems during military missions. Author

N78-23320# Forschungsinstitut fuer Optik, Tuebingen (West Germany).

PHYSICS OF INCOHERENT OPTICAL PROPAGATION

Dieter H. Hoehn *In* AGARD Recent Advan. in Radio and Opt. Propagation for Mod. Commun., Navigation and Detection Systems Apr. 1978 23 p refs (For availability see N78-23318 14-32) Avail: NTIS HC A12/MF A01

Atmospheric optical effects are discussed as relevant to optical/optronical systems, i.e. atmospheric refraction and transmission. The basic relations for atmospheric absorption and scattering are presented. Effects of atmospheric molecules, aerosols, and hydrometeors are described for the wavelength range 0.3 micrometers to 15 micrometers. The general vision formula is presented together with remarks on atmospheric path radiance and on perception range modeling. The definition of visual range and maximum perception range, e.g. with respect to thermal vision through the atmosphere is included. The project OPAQUE is mentioned as an example for the collection of data on atmospheric optical and infrared affects as relevant to the performance of optical/optronical systems and forecasting of the 'optical weather.' Author

N78-23321# Rome Univ. (Italy).

PROPAGATION PROBLEMS RELATIVE TO LASER TRANSMISSION

Mario Bertolotti *In* AGARD Recent Advan. in Radio and Opt. Propagation for Mod. Commun., Navigation and Detection Systems Apr. 1978 29 p refs (For availability see N78-23318 14-32) Avail: NTIS HC A12/MF A01

Atmospheric transmission and scattering of monochromatic beams are considered. The effects of atmospheric turbulence are then described. Thermal blooming is discussed in cases of CW and pulse operation. Author

N78-23322# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.

INTRODUCTION TO RADIO WAVE PROPAGATION EFFECTS ON SYSTEMS

Jules Aarons *In* AGARD Recent Advan. in Radio and Opt. Propagation for Mod. Commun., Navigation and Detection Systems Apr. 1978 6 p (For availability see N78-23318 14-32) Avail: NTIS HC A12/MF A01

Refraction and absorption processes in the lower atmosphere at wavelengths below 3 cm at all angles of elevation are discussed. Ionospheric effects on radio wave propagation of major or minor significance are considered. Author

N78-23323# Leicester Univ. (England). Dept. of Physics.

HIGH FREQUENCY RADIOWAVE PROPAGATION IN THE IONOSPHERE

T. B. Jones *In* AGARD Recent Advan. in Radio and Opt. Propagation for Mod. Commun., Navigation and Detection Systems Apr. 1978 16 p refs (For availability see N78-23318 14-32) Avail: NTIS HC A12/MF A01

The effect of the ionosphere on the performance of a high frequency radio circuit is considered. Reflection at oblique incidence, multipath propagation, and maximum and lowest usable frequencies are discussed along with ground and ionospheric scatter. Methods of calculating the propagation parameters described include prediction from ionospheric models and ray tracing. A number of techniques for evaluating the complete channel response for improved system performance are discussed. J.M.S.

N78-23324# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.

FORECASTING AND PREDICTION OF IONOSPHERIC PARAMETERS

Kenneth Davies *In* AGARD Recent Advan. in Radio and Opt. Propagation for Mod. Commun., Navigation and Detection Systems Apr. 1978 29 p refs (For availability see N78-23318 14-32) Avail: NTIS HC A12/MF A01

The effects of the ionosphere on the radio frequency spectrum are summarized. Long-term predictions and short-term forecasts of ionospheric conditions in the spatial, temporal, and frequency domains are considered along with the various techniques used in preparing predictions and forecasts. Short-term phenomena, such as solar flares, sudden ionospheric disturbances, polar cap events, and geomagnetic storms are treated. J.M.S.

N78-23325# Air Force Geophysics Lab., Hanscom AFB, Mass.

IONOSPHERIC EFFECTS ON SATELLITE NAVIGATION AND AIR TRAFFIC CONTROL SYSTEMS

J. A. Klobuchar *In* AGARD Recent Advan. in Radio and Opt. Propagation for Mod. Commun., Navigation and Detection Systems Apr. 1978 11 p refs (For availability see N78-23318 14-32) Avail: NTIS HC A12/MF A01

Major effects of the ionosphere on radio waves discussed include: (1) time delays greater than the free space wave velocity; (2) polarization rotation of linearly polarized waves; (3) angular refraction or bending of the ray from a geometric straight line; and (4) phase advance of the carrier phase with respect to the free space phase scintillation. Various techniques of correcting for these effects are described. J.M.S.

N78-23326# Air Force Geophysics Lab., Hanscom AFB, Mass.

IONOSPHERIC SCINTILLATIONS: AN INTRODUCTION

Jules Aarons *In* AGARD Recent Advan. in Radio and Opt. Propagation for Mod. Commun., Navigation and Detection Systems Apr. 1978 22 p refs (For availability see N78-23318 14-32) Avail: NTIS HC A12/MF A01

Variations of amplitude, phase, polarization, and angle of arrival produced when the radio wave passes through electron density irregularities of the ionosphere are considered in terms of the effect on communications, navigation, and detection

systems. Scintillation effects on UHF communications systems are described. J.M.S.

N78-23327# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
ARTIFICIAL MODIFICATION OF THE IONOSPHERE
Kenneth Davies *In* AGARD Recent Advan. in Radio and Opt. Propagation for Modern Commun., Navigation and Detection Systems Apr. 1978 31 p refs (For availability see N78-23318 14-32)
Avail: NTIS HC A12/MF A01

Alteration of the ionosphere by radio and by chemical means is discussed from the point of view of the radio communicator. It is indicated that F-region modification provides a relatively secure means of communications because of the highly aspect sensitive characteristics of field-aligned scatter. Author

N78-23328# Leicester Univ. (England). Dept. of Physics.
THE PROPAGATION OF LOW AND VERY LOW FREQUENCY RADIOWAVES
T. B. Jones *In* AGARD Recent Advan. in Radio and Opt. Propagation for Mod. Commun., Navigation and Detection Systems Apr. 1978 22 p refs (For availability see N78-23318 14-32)
Avail: NTIS HC A12/MF A01

The distinctive features of VLF and LF propagation are discussed and the specialized mathematical techniques necessary to calculate the propagation parameters are described. Examples of VLF and LF systems, the Omega and Loran C navigators, are considered. Some of the advantages and disadvantages of communications systems using these frequencies are noted. Author

N78-23329# Heriott-Watt Univ., Edinburgh (Scotland).
REMOTE SENSING
G. E. Peckham *In* AGARD Recent Advan. in Radio and Opt. Propagation for Mod. Commun., Navigation and Detection Systems Apr. 1978 14 p refs (For availability see N78-23318 14-32)
Avail: NTIS HC A12/MF A01

The way in which emitted or reflected electromagnetic radiation is used to obtain information about the atmosphere, land, and sea is briefly described. The use of infrared scanners and radiometers on satellites to examine the land surface and properties of the atmosphere including temperature and composition, is considered. Author

N78-23330# Royal Norwegian Council for Scientific and Industrial Research, Kjeller. Remote Sensing Technology Programme.
TARGET DETECTION AND IDENTIFICATION METHODS BASED ON RADIO- AND OPTICAL WAVES
Dag T. Gjessing *In* AGARD Recent Advan. in Radio and Opt. Propagation for Mod. Commun., Navigation and Detection Systems Apr. 1978 24 p refs (For availability see N78-23318 14-32)
Avail: NTIS HC A12/MF A01

Technological advances in the fields of microwave techniques, electrooptics, and computer technology are discussed in terms of application to target detection/identification systems. Increasing the target identification capability of these sensor systems is emphasized. Tunable lasers and IR heterodyne receivers are among the sensor systems described. Fundamental principles of target signature analysis are examined including the interaction between electromagnetic waves and geometrical objects, the interaction with molecules, and the influence of the motion pattern of the object on the frequency of the scattered electromagnetic wave. J.M.S.

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N78-23331 Kentucky Univ., Lexington.
GALLIUM ARSENIDE PLANAR TYPE TRANSFERRED ELECTRON DEVICES Ph.D. Thesis
Samuel Virgil Bell, Jr. 1977 153 p
Avail: Univ. Microfilms Order No. 7802433

The transferred electron mechanism is analyzed including the formation, drift of space charge domains, and domain dynamics. Schottky barrier gate-gunn effect digital devices (SBG-GEDDs) and two terminal transferred electron devices (TEDs) are compared. The current voltage relationships of SBG-GEDDs are analyzed in the low field region below the threshold of domain nucleation. Current voltage relationships in the dyanmic or domain nucleating region are also examined. These fundamental relationships are used to derive device characteristics such as trigger sensitivity, trigger capability, low field resistance, power consumption, amplification, integrated load resistor, fanout, unidirectionality, time constants, and power delay product. Experimental transferred electron devices fabricated and tested at domain oscillation frequencies of one to three gigahertz are described. A procedure developed for the fabrication of experimental devices and test setups for the various conditions are documented. Dissert. Abstr.

N78-23332 Illinois Univ., Urbana-Champaign.
ON THE DESIGN OF SELF-CHECKING SYSTEMS UNDER VARIOUS FAULT-MODELS Ph.D. Thesis
Jean Andre Dussault 1977 103 p
Avail: Univ. Microfilms Order No. 7803979

Codes that are used to protect against unidirectional errors were studied. Systematic and non-systematic codes were shown to have the same basic structure. The structure of non-systematic unordered codes, more precisely the class of fixed-weight codes was further examined. It was shown that these codes have codewords that can be effectively classified in terms of congruence, cycling and complementation classes. The capabilities of unordered codes were defined with respect to circuit structure and fault models. Some results, based on the previous classification scheme, are presented on the design of two level minimal checkers. Some practical suggestions for and limitations on the use of unordered codes under different fault models are described. Dissert. Abstr.

N78-23333 California Univ., Los Angeles.
DIRECT RECURSIVE ESTIMATION OF NOISE STATISTICS Ph.D. Thesis
Katsumi Ohnishi 1977 78 p
Avail: Univ. Microfilms Order No. 7806509

A Kalman filter requires an exact knowledge of the noise statistics. The problem of identifying the noise statistics was considered. A recursive algorithm for the estimation of the covariances and means of the state and observation noises is presented. The estimated values coverge to their true values in the mean square sense. One of the features of the presented method is that it does not require the state estimation. The stationarity is not assumed for any kind of obtainable data. The identification of the covariances can be done independently from that of the means of noises. Specifically, the covariance of the observation noise can be done without being affected by the other unknown factors of the noise statistics. Explicit formulae, which the means of the state and measurement noises must statisfy, are presented. Dissert. Abstr.

N78-23334# Westinghouse Electric Corp., Pittsburgh, Pa. Research and Development Center.
THIN FILM TRANSISTOR-ADDRESSED DISPLAY DEVICE Final Report
Thomas P. Brody, Fang C. Luo, and David H. Davies Fort Monmouth, N. J. ECOM Sep. 1977 129 p refs
(Contract DAAB07-72-C-0061)
(AD-A052084; Rept-77-9F9-DSPLA-R3; ECOM-72-0061-12)
Avail: NTIS HC A07/MF A01 CSCL 09/5

This is the final report on Contract DAAB07-72-C-0061; the objective of which was an examination of the feasibility of fabricating a multielement dot-matrix display using electroluminescent output and an integrated thin film transistor addressing array. The concepts have been validated, good quality functional displays were made and delivered to the US Army. Three formats

were examined: 6 in. x 6 in., 20 lpi (12,000 elements), 6 in. x 6 in., 30 lpi (25,000 elements) and 6 in. x 3 in. approximately 30 lpi (17,000 elements); the latter display was designed to be integrated into a US Army field system, the TACFIRE forward observer terminal, and the Digital Message Device. Specimen displays are now being fitted into that device for field trials. The TFT arrays met all the expectations of this program. Devices in the array could switch 300 Vpp power, they demonstrated excellent uniformities which allowed the presentation of good grey scale imagery as well as alphanumerics. Devices with extremely low leakage currents (- 1 nA) were achieved. Active matrix arrays containing 90,000 devices (60,000 TFTs and 30,000 capacitors) were made containing only a small number of imperfections, which did not interfere with the operation of the panel. The resulting displays clearly demonstrated the point that the use of the TFT addressing array allows the selection of an optimal display media. GRA

N78-23335*# Naval Surface Weapons Center, White Oak, Md. Ordnance Systems Development Dept.

ANALOG WITHOUT FEAR Final Report

Arthur D. Delagrange 1 Dec. 1977 27 p refs

(AD-A052048; NSWC/WOL/TR-77-173) Avail: NTIS HC A03/MF A01 CSCL 09/3

Analog circuitry, also referred to as Linear, has been nearly run over by the digital/computer bandwagon. This is unfortunate because tremendous advances are being made in the field of analog integrated circuitry. Each year's progress raises the state-of-the-art, bringing achievements not possible even the year before. Many of the traditional prejudices against analog circuitry are no longer valid. This report attempts to summarize what is available now and what can (and can't) be done with analog integrated circuitry. Author (GRA)

N78-23336# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.

A MICROPROCESSOR CONTROLLED MOTOR CONTROLLER FEASIBILITY STUDY Final Report, Dec. 1975 - Jan. 1978

Arthur L. Gulovsen Mar. 1978 98 p

(Contract N00014-77-C-0352)

(AD-A052055; R-1147) Avail: NTIS HC A05/MF A01 CSCL 09/5

A microprocessor controlled motor controller feasibility study has been completed by the Charles Stark Draper Laboratory for the U. S. Navy. In addition to verification of the concept of a microprocessor as the controlling element of a motor control system, design goals included the hardware realization of a control algorithm which maximizes system performance by minimizing harmonic, transient, and steady state current, and also maximizes system reliability by limiting the stresses and overloads to each component. Author (GRA)

N78-23337# United Technologies Research Center, East Hartford, Conn.

LARGE SIGNAL NUMERICAL SIMULATION OF FIELD EFFECT TRANSISTORS

H. L. Grubin Dec. 1977 18 p refs Presented at the 6th Bien. Conf. on Active Microwave Semicond. Devices and Circuits, Cornell Univ., 16-19 Aug. 1977

(Contract N00014-74-C-0237)

(AD-A052047; UTRC/R77-921818-6) Avail: NTIS HC A02/MF A01 CSCL 09/3

A large signal time dependent numerical code has been developed for simulating the space charge and circuit dependence of nonlinear single gate unipolar field effect transistors.

Author (GRA)

N78-23338# Air Force Systems Command, Wright-Patterson AFB, Ohio.

THE USE OF A LOGARITHMIC AMPLIFIER IN DESIGNING AN ALTERNATE-PERIOD COMPENSATOR FOR PASSIVE JAMMING

L. D. Vilesov, E. D. Lapchik, A. R. Lukoshkin, Yu. Ye. Monakov, and A. A. Chude 25 Aug. 1977 14 p Transl. into ENGLISH from Tr. Leningrad. Inst. Aviats. Privorostroyeniya (USSR), no. 55, 1958 p 208-212

(AD-A051472; FTD-ID(RS)T-1502-77) Avail: NTIS HC A02/MF A01 CSCL 09/5

We examine the question of using a logarithmic receiver in designing alternate-period compensation of passive jamming. We give an estimate of the detection efficiency. Author (GRA)

N78-23339# Princeton Univ., N. J. Dept. of Electrical Engineering.

DISTRIBUTION OF FLATBAND VOLTAGES IN LATERALLY NONUNIFORM MIS CAPACITORS AND APPLICATION TO A TEST FOR NONUNIFORMITIES

C. C. Chang and Walter C. Johnson 1 Nov. 1977 25 p refs

(Contracts DAAG53-76-C-0059; DARPA Order 2182)

(AD-A051167; TR-3) Avail: NTIS HC A02/MF A01 CSCL 09/5

The effect of a laterally nonuniform distribution of fixed charge in the insulator of an MIS capacitor can be characterized by a flatband-voltage distribution function. We present a simple, approximate C-V method for determining this distribution, and apply the result to a test for distinguishing between interface states and laterally nonuniform fixed charge. Examples are presented. Author (GRA)

N78-23340# Illinois Univ., Urbana-Champaign. Electromagnetics Lab.

MUTUAL ADMITTANCE BETWEEN SLOTS ON A CYLINDER OR CONE Final Report, 16 Nov. 1976 - 15 Nov. 1977

S. W. Lee and R. Mittra Dec. 1977 196 p refs

(Contract N00019-77-C-0127)

(AD-A051067; UIEM-77-24; UILU-ENG-77-2267; UIEM-77-8; UILU-ENG-77-2549; UIEM-77-13; UILU-ENG-77-2555) Avail: NTIS HC A09/MF A01 CSCL 20/3

The present contract studied the mutual admittance between two thin slots on a conducting cylinder or a cone by ray techniques. Our main contribution in the development of an approximate asymptotic Green's function for the surface function, expressed in terms of Fock functions, is simple to evaluate, and gives excellent numerical results when compared with known exact solutions and/or experimental data. This report contains a brief administrative summary plus three attachments which give the technical details. GRA

N78-23341# Georgia Inst. of Tech., Atlanta. Applied Sciences Lab.

RELIABILITY FACTORS FOR ELECTRONIC COMPONENTS IN A STORAGE ENVIRONMENT Final Report, 21 Apr. 1975 - 31 Jul. 1977

B. R. Livesay and E. J. Scheibner Sep. 1977 248 p refs

(Contract DAAH01-75-C-0782)

(AD-A051151; GIT-DD-14-23) Avail: NTIS HC A11/MF A01 CSCL 09/3

The long-term storage reliability of electronic components in U.S. Army missile systems is approached from the viewpoint of materials degradation phenomena. A survey of missile systems is made to illustrate the wide range of tactical missiles and the different electronic technologies used. Data on world-wide environments, particularly temperature variations, are included to indicate the nature of storage environmental stresses acting on the missile and its electronic components. Failure processes resulting from these environmental stresses are discussed in terms of mechanical, thermal-mechanical, chemical and thermal effects. Further specific discussions are included on hermeticity, polymers, oxides and statistics. The conclusions and recommendations include several items which suggest changes in component reliability policies and recommendations are made for future research efforts in storage reliability. An extensive bibliography is included. Author (GRA)

N78-23342# Radio Corp. of America, Somerville, N. J.

DESIGN OF A DIGITAL PHASE-LOCKED-LOOP CMOS UNIVERSAL ARRAY Final Report, Mar. 1975 - Nov. 1976

R. H. Bergman, G. E. Korup, and R. E. Funk Sep. 1977 40 p refs

(Contract F33615-75-C-1252)

(AD-A051533; PRRL-76-CR-54; AFAL-TR-77-258) Avail: NTIS HC A02/MF A01 CSCL 09/2

A digital phase-locked-loop circuit developed by The Charles Stark Draper Laboratory, Inc. and sponsored by the Air Force Avionics Laboratory, was successfully implemented on an RCA TCC 051 universal array (type number TCC 051 820). Twenty

engineering prototypes were evaluated by the contracting agency and found acceptable. Additional 150 units were subsequently supplied. A market study was made of the commercial applicability of the DPLL LSI design. Author (GRA)

N78-23343# Edgerton, Germeshausen and Grier, Inc., Salem, Mass. Electronic Components Div.

REPETITIVE SERIES INTERRUPTER II Triannual Report No. 5, 1 Jun. - 30 Sep. 1977

Robert Simon and David V. Turnquist Jan. 1978 34 p ref (Contract DAAB07-76-C-1301; DA Proj. 1L7-62705-AH-94) (AD-A051608; ECOM-76-1301-5) Avail: NTIS HC A03/MF A01 CSCL 09/5

Further development of the Repetitive Series Interrupter thyratrons is described. A series of tubes containing magnetic interaction regions with chuted wall internal surfaces has been designed and is under construction. Efforts to eliminate restrike continue with the study of grid biasing and anode-grid region magnetic field pulsing. Alternate interruption geometries are tested. Author (GRA)

N78-23344# Electronics Engineering Group (1842nd), Scott AFB, Ill.

FREQUENCY DIVISION MULTIPLEX BASEBAND CABLE PLANT PERFORMANCE IMPROVEMENT Final Report

Frank LaDieu 1 Feb. 1978 260 p refs (AD-A051271; Rept-1842-EEG/EETTW-TR-78-9) Avail: NTIS HC A12/MF A01 CSCL 17/2

This report provides an in-depth discussion of the noise problems that are encountered in existing Defense Communications System frequency division multiplex baseband cable plants. The causes of these problems are cited; test procedures to isolate and identify specific deficiencies are provided. Corrective techniques and their application for the reduction of noise within existing facilities are described. Often quoted (but unsuccessful in practice) methods for reducing RFI in TRIAX cable plants are discussed in terms of test results. System degrading measurement methods used to accomplish baseband sweeps and read baseband loading are disclosed. And finally, the economics of recovery of logged out communications channels are treated. Author (GRA)

N78-23345# Pisa Univ. (Italy). Ist. di Elettrotecnica.

THE CURRENTS ABSORBED BY THE MOTOR WITH DOUBLE ROTOR CASING DURING OPERATION EXPRESSED BY MEANS OF PARAMETERS TO BE DETERMINED EXPERIMENTALLY [LE CORRENTI ASSORBITE DAL MOTORE A DOPPIA GABBIA NEL TRANSITORIO ESPRESSE TRAMITE PARAMETRI DETERMINABILI SPERIMENTALMENTE]

G. Carrara and A. Moretti [1977] 13 p refs In ITALIAN (Rept-1600) Avail: NTIS HC A02/MF A01

The course of the currents absorbed by an asynchronous motor with double rotor casing during the electromagnetic transient phases under operational conditions was determined analytically. To speed up the analytical process the equivalent biaxial machine with straight axis was considered, containing two sets of windings on the stator and four on the rotor, two being equivalent to the external casing and two to the internal one. The differential equations of the electromagnetic equilibrium, containing the parameters of the machine and the angular velocity, are resolved by operational calculus. The number is reduced from 6 to 3 introducing complex numbers relative to the power supply, stator current, and currents in the casings. This permits the graphical determination of the currents absorbed by the machine through the space described by the vector representing the complex number relative to the stator currents. The theoretical results were compared with the experimental ones with optimal results. ESA

N78-23346# Pisa Univ. (Italy). Ist. di Elettrotecnica.

ON A SPECIAL SYSTEM FOR THE VELOCITY CONTROL OF A DIRECT CURRENT MOTOR [SU UN PARTICOLARE SISTEMA DI REGOLAZIONE DELLA VELOCITA DI UN MOTORE IN CORRENTE CONTINUA]

O. Bruno, F. Capparelli, and G. Zini [1977] 7 p In ITALIAN Sponsored by CNR (Rept-1613) Avail: NTIS HC A02/MF A01

A special system is proposed for keeping the rotational speed of a direct current motor constant independent of the variations of the couple applied to it. The equilibrium states of the system are determined and the limits of variability of the parameter on which the velocity depends are established. The stability conditions of the equilibrium state are studied and the limits of variability of the speed and of the couple applied to the axis are determined. ESA

N78-23347# Pisa Univ. (Italy). Ist. di Elettrotecnica.

ELECTROMAGNETIC TRANSIENT PHASES IN ASYNCHRONOUS MOTORS WITH DOUBLE ROTOR CASING CAUSED BY INSTANTANEOUS POWER SUPPLY TENSION VARIATIONS [TRANSITORI ELETTROMAGNETICI NEL MOTORE ASINCRONO A DOPPIA GABBIA PER EFFETTO DI VARIAZIONI ISTANTANEE DELLA TENSIONE DI ALIMENTAZIONE]

G. Carrara and A. Moretti [1977] 14 p refs In ITALIAN (Rept-1614) Avail: NTIS HC A02/MF A01

The instantaneous currents absorbed by a motor with double rotor casing in electromagnetic transient phases, resulting from abrupt symmetrical variations of the power supply tension, are expressed in relations obtained by solving the equilibrium equations of the biaxial equivalent machine according to the operational calculus principle. The coefficients of these relations contain machine parameters that can be obtained numerically from normal experiments. The validity of the method is checked by comparing the analytical course with the experimental oscillograms. Two special cases are dealt with: a three phase short cut in the power supply line and inversion of the cyclic sense of the tension applied to the motor. ESA

N78-23348# Laboratoire Central de Recherches Thomson-CSF, Orsay (France). Lab. Composants Rapides.

FEASIBILITY OF GUNN EFFECT PLANAR TRIODES FOR HIGH SPEED ELECTRONICS Final Report [ETUDE DE LA FAISABILITE DE TRIODES PLANAR A EFFET GUNN UTILISABLES EN ELECTRONIQUE RAPIDE]

Maurice Gloanec Dec. 1976 65 p refs In FRENCH (Contract DGRST-75-7-0668) (LCR-1539/CL) Avail: NTIS HC A04/MF A01

Planar Gunn devices with a Schottky trigger grid, operating in dynamical dipolar mode, were made in various geometries by vapor phase epitaxy of Ga-As-N on GaAs. The N layer characteristics at 2 micron thickness were optimized to obtain a good pulse shaping with rise times lower than 100 picoseconds and low power consumption (70 to 250 mW at rest). Simple theoretical models can be used to forecast static and dynamic characteristics. The devices presented are shown to be useful for data transfers at rates higher than two Gbits/sec. A nondestructive characterization method, a test procedure, and a fabrication methodology are described. ESA

N78-23349# Chalmers Univ. of Technology, Goteborg (Sweden). School of Electrical Engineering.

THE INFLUENCE OF THE HARMONICS IN THE INVERTER-FED ASYNCHRONOUS MACHINE Ph.D. Thesis

Lars Gertmar Oct. 1976 205 p refs Partly in SWEDISH and partly in ENGLISH (CTH-TR-66) Avail: NTIS HC A10/MF A01

The consequences of using a thyristor inverter for asynchronous machine speed change were investigated with regard to the voltage harmonics produced. Torque and rotor speed pulsations are dealt with and equivalent circuits derived from which a nonlinear complex equation system can be solved. Additional losses in the iron were studied with the help of a toroidal transformer to show that the voltage wave shape increases the iron loss by a few percent. A numerical spectral analysis was performed with an ADC system and minicomputer to determine voltage, current, and power spectra. ESA

N78-23350# Technical Research Centre of Finland, Helsinki. Electronics Lab.

DIGITAL AND ANALOGUE SIMULATION OF TRANSIENT INTERMODULATION DISTORTION

Eero Leinonen 1977 30 p refs (VTT-ENT-18; ISBN-951-38-0508-5) Avail: NTIS HC A03/MF A01

The dynamic properties of an amplifier which produces TIM (Transient Intermodulation Distortion) under certain working conditions is studied using an amplifier model, which is accomplished both by computer programs and by an operational amplifier circuit. Numeric values for TIM-producing drive signal overshoots and resulting amplifier overload duration are calculated as functions of amplifier parameters. Results obtained by different methods agree well with each other. Author (ESA)

N78-23351# European Space Research and Technology Center, Noordwijk (Netherlands). Product Assurance Div.

ESA GENERIC PROCUREMENT SPECIFICATION NO. QRC-31 FOR THICK FILM HYBRID MICROCIRCUITS

Paris ESA Nov. 1977 54 p
(ESA-Spec-QRA-31-Issue-2) Avail: NTIS HC A04/MF A01

This generic procurement specification covers the procurement and delivery requirements for thick film hybrid microcircuits suitable for space application. It will be used in conjunction with the detail specification applicable to the actual device type and is valid only for procurement from manufacturers who have been qualified by ESTEC in accordance with ESA Specification No. QRC-06. Author (ESA)

N78-23352# European Space Research and Technology Center, Noordwijk (Netherlands). Product Assurance Div.

THE CRIMPING OF HIGH-RELIABILITY ELECTRICAL CONNECTIONS

Paris ESA Sep. 1977 22 p
(ESA-PSS-41/QRM-26P-Issue-1) Avail: NTIS HC A02/MF A01

The minimum ESA requirements and quality assurance provisions for crimping wire terminations intended for high-reliability electrical connections are specified. These terminations include removable contacts, coaxial connectors, and ferrules which are crimpled to wire conductors and other electrical or electronic components for use on spacecraft and assemblies operating under high vacuum, thermal cycling, and vibration. Author (ESA)

N78-23353# European Space Agency, Paris (France).

ANALYSIS OF THE FUNCTIONING AND LONG-TERM DEGRADATION OF PERFORMANCE OF A HIGH-FREQUENCY TRANSISTOR OSCILLATOR

M. Pollacsek and J. G. Ferrante Mar. 1978 14 p refs Transl. into ENGLISH from ESA Journal (Paris), v. 1, no. 2, 1977 p 155-164 Original report in FRENCH previously announced as A77-48653
(ESA-TT-442) Avail: NTIS HC A02/MF A01

Analysis of the functioning of an electronic circuit is an essential step prior to evaluation of degradation of performance with time (aging of components, variation in the characteristics, etc.). The functioning of a high-frequency transistor oscillator was analyzed using the computer aided design program ESAMEC, with emphasis on its modelling, research on the nominal operating point, and the need to obtain data on the variation of critical parameters with time. The latter data is essential in order to realistically predict the long-term degradation of the circuit analyzed, particularly when it is designed to be flown on board an applications satellite that has a planned lifetime of the order of five to seven years. Author (ESA)

N78-23354 National Technical Information Service, Springfield, Va.

PRINTED CIRCUITS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1972 - 1976

William E. Reed Mar. 1978 221 p
(NTIS/PS-78/0220/0) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 09E

Citations from the design, fabrication, testing, and applications of printed circuits are presented. Topics covered include computer aided design, soldering, etching, plating, photolithography, and materials. This updated bibliography contains 216 abstracts. GRA

N78-23355 National Technical Information Service, Springfield, Va.

PRINTED CIRCUITS, VOLUME 3. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Feb. 1978

William E. Reed Mar. 1978 88 p Supersedes NTIS/PS-77/0176; NTIS/PS-76/0155 and NTIS/PS-75/234
(NTIS/PS-78/0221/8; NTIS/PS-77/0176; NTIS/PS-76/0155; NTIS/PS-75/234) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 09E

For abstract, see N78-23354.

N78-23356 National Technical Information Service, Springfield, Va.

PRINTED CIRCUITS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1975 - Feb. 1978

William E. Reed Mar. 1978 274 p Supersedes NTIS/PS-77/0177 and NTIS/PS-76/0156
(NTIS/PS-78/0222/6; NTIS/PS-77/0177; NTIS/PS-76/0156) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 09E

For abstract, see N78-23354.

N78-23357 National Technical Information Service, Springfield, Va.

BAND PASS FILTERS, VOLUME 1. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jan. 1977

William E. Reed Mar. 1978 215 p
(NTIS/PS-78/0214/3) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 09E

Citations on the design, fabrication, characterization, and application of band pass filters are presented. Topics covered include radio frequency, digital, acoustic surface wave, and X-ray filters. This updated bibliography contains 210 abstracts. GRA

N78-23358 National Technical Information Service, Springfield, Va.

BAND PASS FILTERS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, Feb. 1977 - Jan. 1978

William E. Reed Mar. 1978 102 p Supersedes NTIS/PS-77/0142; NTIS/PS-76/0145 and NTIS/PS-75/188
(NTIS/PS-78/0215/0; NTIS/PS-77/0142; NTIS/PS-76/0145; NTIS/PS-75/188) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 09E

For abstract, see N78-23357.

N78-23359 National Technical Information Service, Springfield, Va.

BAND PASS FILTERS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1974 - Feb. 1978

William E. Reed Mar. 1978 274 p Supersedes NTIS/PS-77/0143 and NTIS/PS-76/0146
(NTIS/PS-78/0216/8; NTIS/PS-77/0143; NTIS/PS-76/0146) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 09E

For abstract, see N78-23357.

N78-23360 National Technical Information Service, Springfield, Va.

SWITCHING CIRCUITS, VOLUME 1. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1970 - Jan. 1977

William E. Reed Mar. 1978 302 p
(NTIS/PS-78/0217/6) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 09E

The theory and applications of switching circuits are covered. Production engineering measures, logic design, microelectronics, and system reliability are included. This updated bibliography contains 297 abstracts. GRA

N78-23361# National Technical Information Service, Springfield, Va.

SWITCHING CIRCUITS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, Feb. 1977 - Jan. 1978

William E. Reed Mar. 1978 91 p Supersedes NTIS/PS-77/0106; NTIS/PS-76/0089 and NTIS/PS-75/128
(NTIS/PS-78/0218/4; NTIS/PS-77/0106; NTIS/PS-76/0089; NTIS/PS-75/128) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 09E

For abstract, see N78-23360.

N78-23362 National Technical Information Service, Springfield, Va.

SWITCHING CIRCUITS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1972 - Jan. 1978
William E. Reed Mar. 1978 201 p Supersedes NTIS/PS-77/0107 and NTIS/PS-76/0090
(NTIS/PS-78/0219/2; NTIS/PS-77/0107; NTIS/PS-76/0090) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 09E
For abstract, see N78-23360.

N78-23363 National Technical Information Service, Springfield, Va.
HYBRID MICROELECTRONIC CIRCUITS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Feb. 1978
William E. Reed Mar. 1978 263 p Supersedes NTIS/PS-77/0220
(NTIS/PS-78/0211/9; NTIS/PS-77/0220) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 09E
A bibliography presents Federally-sponsored research reports relating to the technology of thick and thin film hybrid microcircuits. Research on the design, materials, processing fabrication, quality control, reliability, and applications of the circuits was included. GRA

N78-23364# National Technical Information Service, Springfield, Va.
HYBRID MICROELECTRONIC CIRCUITS, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1975 - Feb. 1978
William E. Reed Mar. 1978 248 p Supersedes NTIS/PS-77/0222
(NTIS/PS-78/0212/7; NTIS/PS-77/0222) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 09E
Research reports from worldwide literature relating to the technology of thick and thin film hybrid microcircuits are cited. Research on the design, materials, processing, fabrication, quality control, reliability, and applications of the circuits was included. GRA

N78-23365 National Technical Information Service, Springfield, Va.
TRANSISTOR AMPLIFIERS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Feb. 1978
William E. Reed Mar. 1978 269 p Supersedes NTIS/PS-77/0202; NTIS/PS-76/0233; NTIS/PS-75/288
(NTIS/PS-78/0225/9; NTIS/PS-77/0202; NTIS/PS-76/0233; NTIS/PS-75/288) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 09A
The design, development, and applications of transistor amplifiers are covered in the cited reports. Research on reliability and radiation effects is included. GRA

N78-23366 National Technical Information Service, Springfield, Va.
ELECTRON BEAM SEMICONDUCTOR DEVICES. CITATIONS FROM NTIS DATA BASE Progress Report, 1964 - Feb. 1978
William E. Reed Mar. 1978 70 p Supersedes NTIS/PS-77/0158; NTIS/PS-76/0122; NTIS/PS-75/190
(NTIS/PS-78/0174/9; NTIS/PS-77/0158; NTIS/PS-76/0122; NTIS/PS-75/190) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 09A
Federally-sponsored research reports are cited covering the design, development, fabrication, and application of electron beam semiconductor devices. Applications include amplifiers, pulse generators, image tubes, switches, and electron beam memory devices. GRA

N78-23367 National Technical Information Service, Springfield, Va.
ELECTRON BEAM SEMICONDUCTOR DEVICES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jan. 1978
William E. Reed Mar. 1978 83 p Supersedes NTIS/PS-77/0159; NTIS/PS-76/0123
(NTIS/PS-78/0175/6; NTIS/PS-77/0159; NTIS/PS-76/0123) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 09A
The bibliography cites worldwide research on the design, development, fabrication, performance, and application of electron beam semiconductor devices. Applications include amplifiers, image tubes, memory devices, pulse generators, and electron beam pumped semiconductor lasers. GRA

N78-23368 National Technical Information Service, Springfield, Va.
LIGHTING, SURGE, AND TRANSIENT PROTECTION. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Feb. 1978
William E. Reed Mar. 1978 267 p
(NTIS/PS-78/0187/1; NTIS/PS-77/0099; NTIS/PS-76/0119; NTIS/PS-75/258) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 09C
Techniques and devices for the protection of electronic and electrical equipment are presented in these Federally-sponsored research reports. The citations include research on suppressors, limiters, lightning arresters, electromagnetic pulse protection devices, and overvoltage protection networks. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.
For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N78-23369 Minnesota Univ., Minneapolis.
EXPERIMENTS ON BUOYANCY-AFFECTED AND BUOYANCY-UNAFFECTED TURBULENT HEAT TRANSFER FOR WATER IN A TUBE WITH CIRCUMFERENTIALLY NONUNIFORM HEATING Ph.D. Thesis
Roger Ray Schmidt 1977 263 p
Avail: Univ. Microfilms Order No. 7802713
Experiments were performed to determine the heat transfer characteristics of turbulent flow in a horizontal circular tube with circumferentially varying wall heat flux. Heat transfer results are presented for both buoyancy-affected and buoyancy-unaffected flows. The experiments were carried out with water as the working fluid. For those conditions which combined low Reynolds numbers and high Rayleigh numbers, significant effects of buoyancy were observed in the circumferential variation of the temperature and heat transfer coefficient for bottom heating. In general, results for buoyancy-affected bottom heating displayed relatively uniform wall temperatures and heat transfer coefficients. In marked contrast, significant circumferential variations in the temperature and heat transfer coefficients were evident for the buoyancy-unaffected top heating cases. Dissert. Abstr.

N78-23370 Tulsa Univ., Okla.
A NUMERICAL SIMULATION MODEL FOR TRANSIENT TWO-PHASE FLOW IN A PIPELINE Ph.D. Thesis
Myles Wilson Scoggins, Jr. 1977 145 p
Avail: Univ. Microfilms Order No. 7803839
A mathematical model was developed to simulate isothermal, transient two-phase flow of gas and liquid in a pipeline. A system of three nonlinear partial differential equations was derived as a basis for the model. Characteristics analysis indicates that the differential system is hyperbolic and, thus, well-posed as an initial value problem. After some rearrangement of the differential system and a change of variables, the desired forms of the model equations were approximated by implicit finite difference analogues. A sequential solution algorithm was developed for the difference equations and programmed for computer usage. Experimental transient two-phase flow data were obtained and were used to establish the validity of the mathematical model. Dissert. Abstr.

N78-23371 Colorado State Univ., Fort Collins.
DIFFUSION IN DEVELOPING TURBULENT FLOW Ph.D. Thesis
Karvigh A. Hassan 1977 311 p
Avail: Univ. Microfilms Order No. 78-02351
The dispersion of matter in an open channel under conditions of steady, two dimensional, developing and fully developed flow

is investigated. The method of approach used to predict heat and mass transfer in turbulent boundary layer, is extended to the solution of the problems of the diffusion of solid particles of finite sizes in open channel flows with different bed roughnesses. The momentum and diffusion equations are solved numerically utilizing a finite difference technique and a marching-integration procedure. The mathematical models used for the turbulent exchange coefficients are those involving the eddy viscosity and mixing length. Various combinations of boundary and other input conditions are imposed and their effect on the results is demonstrated. The solution procedure described is used to compare experimental data with calculated velocity and concentration distributions to demonstrate the capabilities of the method.
Dissert. Abstr.

N78-23372 Michigan Univ., Ann Arbor.
ASYMPTOTIC ANALYSIS OF INTERACTION BETWEEN A NORMAL SHOCK WAVE AND A TURBULENT BOUNDARY LAYER IN TRANSONIC FLOW Ph.D. Thesis
Meng-Sing Liou 1977 180 p
Avail: Univ. Microfilms Order No. 7804752

The method of matched asymptotic expansions was employed to seek self-consistent solutions valid in the double limit as Reynolds number approaches infinity and Mach number tends to unity. The case considered was that where the nondimensional friction velocity is small compared to the dimensionless difference between the external flow fluid velocity and critical sound speed, so that the sonic line is located deep in the boundary layer. As a result, the interaction zone is composed of inner and outer regions in the streamwise direction. Each of these regions is further subdivided into three layers in the transverse direction: an inviscid layer, a wall layer, and an additional layer between them. Solutions were obtained in each layer of the regions concerned and were matched asymptotically in the neighboring layers and regions. Dissert. Abstr.

N78-23373 Florida Univ., Gainesville.
A MACHINE LEARNING APPROACH TO FOLLOWING TRACE PARTICLES IN TURBULENT FLOW Ph.D. Thesis
Randel Allan Crowe 1977 199 p
Avail: Univ. Microfilms Order No. 7806686

Machine learning was used in a statistical decision theoretic scheme to follow trace particles in turbulent flow. Data used to demonstrate performance came from previous experiments studying turbulent flow in a pipe (Reynolds number less than 6500), and consisted of digitized stereoscopic trace particle image locations. Accuracy of the data acquisition technique was examined with emphasis on optical errors. Particle location in the pipe was determined from its two stereo images. However, high trace particle count prevents immediate pairing of particle's stereo images. It was concluded that a semiautomated system is necessary where the particle following procedure's output is verified by an operator who can change or correct decisions made. Dissert. Abstr.

N78-23374 Pennsylvania Univ., Philadelphia.
APPROXIMATE METHODS IN FLUID-STRUCTURE INTERACTION PROBLEMS Ph.D. Thesis
Alfred Vanallan Clark, Jr. 1977 88 p
Avail: Univ. Microfilms Order No. 7806566

Some approximate methods of calculating the response of structures submerged in an infinite acoustic fluid are considered. A characteristic body dimensioned, and corresponding fluid-structure interaction time t bar, are defined by t bar = d/c; c is the sound velocity in the fluid. The approximation proposed is a generalization of the hydrodynamic function for a rigid-body translation of a sphere. This allows the impedance offered by the fluid to be modelled by the driving point impedance of an equivalent mechanical circuit consisting of a mass, spring, and dapmer. Formulas are given for determining the values of these mechanical elements. To test the quality of the proposed approximation, it is compared to the hydrodynamic functions appropriate to translating cylinders, strips, and unbaffled discs.
Dissert. Abstr.

N78-23375 Rutgers - The State Univ., New Brunswick, N. J.
AN EXPERIMENTAL STUDY OF DROPLET RESPONSE TO WEAK SHOCK WAVES Ph.D. Thesis
Sung Soo Kim 1977 216 p
Avail: Univ. Microfilms Order No. 7805094

An experimental study of the response of small water droplets to weak shock waves was performed in shock tube. Controlled steams of droplets were produced by means of the capillary instability of a laminar jet. The droplets were allowed to fall through the test section of a shock tube, and were exposed to shock waves with strengths in the range between 0.01 and 0.3. The corresponding initial Weber numbers varied from about 0.001. Droplet displacement data obtained by means of photographic techniques using high-speed stroboscopic illumination. Droplet trajectories were recorded on single negatives. These trajectories were fitted by means of a best-fit third-degree polynomials in time, which in turn were used to obtain droplet velocity, acceleration and drag. Dissert. Abstr.

N78-23376 Texas A&M Univ., College Station.
AN ANALYTICAL MODEL FOR THE HEAT TRANSFER TO A CAPILLARY GROOVE Ph.D. Thesis
Sherman Perry Goplen 1977 71 p
Avail: Univ. Microfilms Order No. 7806801

An analytical model for describing the heat transfer from the wall of a capillary groove to the fluid in the groove was developed. This model couples a one-dimensional conduction model in the wall to the surface heat transfer mechanisms resulting from a meniscus formed on the wall. The conduction resistance of the thin liquid film is neglected and only the resistance due to the short range attraction forces is considered in the evaporating film region. In the intrinsic meniscus region both the conduction effects through the film and the surface resistance to evaporation are accounted for. The results show that the heat transfer starts at approximately zero at the base of the equilibrium thin film and increases in the evaporating thin film region to a maximum at the transition region between the evaporating film and intrinsic meniscus. The heat transfer then decreases as the conduction resistance of the film increases. Data is presented illustrating the relative importance of each of these heat transfer mechanisms. Dissert. Abstr.

N78-23377 Missouri Univ., Rolla.
HEAT TRANSFER AND WAVE INSTABILITY OF MIXED FORCED AND FREE CONVECTION FLOW Ph.D. Thesis
Aleksandros Mucoglu 1977 304 p
Avail: Univ. Microfilms Order No. 7805006

Mixed convection heat transfer laminar flow over a horizontal flat plate, across a horizontal cylinder, and around a sphere was analyzed for both assisting and opposing flow conditions under two surface heating conditions, the uniform wall temperature and the uniform surface heat flux. For an equivalent buoyancy force effect, heating by uniform surface heat flux provides higher local Nusselt numbers than heating by uniform wall temperature. Isothermal vertical and horizontal flat plates were considered in the study of the linear wave instability of laminar mixed forced and free convective flow. Flow along the vertical flat plate becomes more stable as the buoyancy force increases for assisting flow and becomes less stable as the buoyancy force increases for opposing flow. These trends are reversed for flow over the horizontal flat plate. Dissert. Abstr.

N78-23378 Cornell Univ., Ithaca, N. Y.
GEOTHERMAL ENERGY-RELATED PROBLEMS OF NATURAL CONVECTION IN POROUS MEDIA Ph.D. Thesis
Robert John Ribando 1977 179 p
Avail: Univ. Microfilms Order No. 7805723

The effects of a number of variables on natural convection in a two-dimensional saturated porous layer are assessed. The effects of constant temperature and constant heat flux lower thermal boundary conditions are contrasted, as are the effects of permeable and impermeable upper boundaries. Cases with spatially varying permeability are presented. The critical Rayleigh number is derived for several sets of boundary conditions, and results at several values of Rayleigh number are presented for nearly all the sets of boundary conditions considered. The surface heat fluxes computed in these saturated layer cases are used to interpret the sinusoidally-varying heat fluxes measured in the ocean floor transverse to the axis of a mid-ocean spreading center. The results show that barring hot springs, the convective

component of surface heat flux is very small even with mass flow through a permeable upper boundary. Dissert. Abstr.

N78-23379 California Univ., Los Angeles.
THERMOMECHANICAL GORTER MELLINK CONVECTION OF LIQUID HELIUM II IN A DUCT WITH ZERO AND FINITE ANGULAR VELOCITIES, AND THE INFLUENCE OF INTERFACIAL INSTABILITY UPON A HEATED HELIUM II BOUNDARY LAYER Ph.D. Thesis
Steven Charles Soloski 1977 336 p
Avail: Univ. Microfilms Order No. 7806526

The axial heat flux (peak) at crisis was measured in He 2 in an insulated annular duct with the heater at the bottom. A nondimensional thermomechanical correlation was developed which satisfactorily described the axial flow of heat in an insulated duct. Thermomechanical convection in the He 2 boundary layer at the surface of a flat plate heater was calculated on the basis of a microscopic model which incorporated an interfacial breakup. A dominant size in the unstable range of wavenumbers of the heated boundary layer was obtained by stability considerations on the interface with the bulk fluid. The resulting heat flux equations correctly predicted the magnitude and temperature dependence of the peak heat flux from a surface. Dissert. Abstr.

N78-23380 Dartmouth Coll., Hanover, N.H.
A STUDY OF DRAG FORCES ACTING ON A SPHERICAL PARTICLE IN A FLAT PLATE BOUNDARY LAYER FLOW Ph.D. Thesis
Douglas George Boike 1978 187 p
Avail: Univ. Microfilms Order No. 7806924

The flow and particle detachment physics were studied for the entrance region flow of a simple vacuum port suspended above a flat surface. A non-dimensional flow model was first developed and verified for this entrance region. A series of actual single particle detachment trials in air were then performed using the scale model apparatus and various scale model particles. The experimental results were analyzed with the aid of the flow model to establish an empirical correlation for the drag coefficient in such a geometry as a function of the particle Reynolds No. based on the average fluid velocity across the particle. Simple detachment experiments were performed with multiparticle distributions in air and water. When analyzed, these results showed significantly lower drag coefficients than single particle detachments. Dissert. Abstr.

N78-23381 Northwestern Univ., Evanston, Ill.
FLUID FLOW THROUGH A LARGE VERTICAL CRACK IN THE EARTH'S CRUST Ph.D. Thesis
Show-Peng Chang 1977 89 p
Avail: Univ. Microfilms Order No. 78-05251

The crack profile and stress intensity factors for a two dimensional crack with fluid flowing through it were determined. The entrance and exit portals for the fluid were placed away from the tips of the crack. For cracks of half heights greater than fifty meters with fluid flowing through them of viscosity and density of that of water, it was found that the crack profile and stress intensity factors were essentially the same as that of fluid filled crack in which the fluid was stationary. The extension of the theory of fluid flow through vertical cracks was developed by taking into account a source and a sink positioned on the crack axis. Both kinematical and dynamical aspects of the flow field were utilized to establish the fundamental equations and boundary conditions of the flow system. The functional equation was then reduced to an integral equation and a general solution was found. Dissert. Abstr.

N78-23382 Engineering Sciences Data Unit, London (England).
FLUCTUATING LOADS AND DYNAMIC RESPONSE OF BODIES AND STRUCTURES IN FLUID FLOWS: BACKGROUND INFORMATION
Dec. 1977 59 p
(ESDU-77032; ISBN-0-85679-205-5) For information on availability of series, sub-series, and other individual data items, write NTIS, attn: ESDU, Springfield, Va. 22161. HC $434.50

The present item provides a descriptive introduction to the potential problems and calculation of dynamic forces and response of bodies and structures in fluid flows. A general discussion of some commonly distinguished phenomena such as vortex shedding, galloping, and flutter is followed by an extensive survey of methods of avoiding or alleviating unsteady response problems. Guidance on the types of body most susceptible to particular types or consequences of unsteady phenomena is given in a simple tabular format. The basic principles of representation of fluid forces for both deterministic and random variation cases, and a brief introduction to analysis of structural vibration, are given. The item also covers the essentials of the solution of the governing equations for the response and stability of bodies in fluid flows. ESDU

N78-23383 Engineering Sciences Data Unit, London (England).
PRESSURE LOSSES IN CURVED DUCTS: COILS
Nov. 1977 25 p
(ESDU-77029; ISBN-0-85679-202-0) For information on availability of series, sub-series, and other individual data items, write NTIS, attn: ESDU, Springfield, Va. 22161. HC $434.50

The item deals with coils of both constant radius-helices, or varying radius-spirals, and is used to calculate the pressure losses for single-phase flow in coils. The effects of pitch, surface roughness of coil tubing, and variations of fluid properties, due to significant heat transfer, are included. The data may be applied to coiled heat exchangers as used in chemical and mechanical industrial process plants, heating and ventilation, and domestic equipment. ESDU

N78-23384*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH TEMPERATURE HEAT PIPE RESEARCH AT NASA LEWIS RESEARCH CENTER
L. K. Tower and W. B. Kaufman 1978 15 p refs Presented at the 3d Intern. Heat Pipe Conf., Palo Alto, Calif., 22-24 May 1978; sponsored by AIAA
(NASA-TM-78832; E-9537) Avail: NTIS HC A02/MF A01 CSCL 20D

High temperature refractory metal heat pipes with alkali metal working fluids, for use in thermionic space power systems, were studied. The main effort involved a concept for an out-of-core thermionic nuclear reactor power system. For this a lithium filled heat pipe of 335 cm length with 18 kW capacity was built in several modifications, one of them ultimately tested. Fabrication studies included the manufacture of a heat pipe tube of wire reinforced tantalum by chemical vapor deposition (CVD) and the extension to a reinforced pipe with integral arteries made by the CVD process. A lithium-filled CVD tungsten heat pipe of about 3 kW capacity ran several thousand hours above 1800 K. Materials compatibility studies of several liquid metals in tantalum alloy pipes were performed. Author

N78-23385*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STIFFNESS OF STRAIGHT AND TAPERED ANNULAR GAS PATH SEALS
David P. Fleming 1978 23 p refs Proposed for presentation at Lubrication Conf., Minneapolis, 24-26 Oct. 1978; cosponsored by ASME and Am. Soc. Mech. Engr.
(NASA-TM-78872; E-9576) Avail: NTIS HC A02/MF A01 CSCL 20D

Radial stiffness of annular (ring-type) gas path seals are calculated for both constant-clearance designs and tapered designs for which the inlet clearance is larger than the outlet clearance. Under some conditions a constant-clearance seal can have a negative stiffness; this undesirable property is completely eliminated by use of tapered seals. Leakage rates are only moderately higher in tapered seals. Author

N78-23386# Newcastle Univ. (Australia). Dept. of Mechanical Engineering.
JOINT PROBABILITY DENSITIES AND QUADRANT CONTRIBUTIONS IN A HEATED TURBULENT ROUND JET
K. R. Sreenivasan and R. A. Antonia 18 Jul. 1977 32 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Sept. 1978
Avail: NTIS HC A03/MF A01

Conditional (turbulent) isodensity contours and cross sections of the joint probability density functions of the axial and radial velocity fluctuations, and temperature fluctuation are

presented at three radial positions of a slightly heated turbulent round jet. These positions correspond respectively to the axis of the jet, the position where the production of turbulent energy is maximum, and a position where the flow is strongly intermittent. A detailed comparison with appropriate bivariate Gaussian density functions shows that departures from Gaussianity are only slight on the axis, but increase significantly with increasing radial distance. Gaussian estimates for occupancy times and quadrant contributions are good in regions where the flow is nearly fully turbulent, and poor in regions where the flow is strongly intermittent, even when conditionally turbulent quantities are considered. Author

N78-23387# Polish Academy of Sciences, Warsaw.
COMPUTATION OF FLOW ABOUT AN ARBITRARY SYSTEM OF DISCS
Wlodzimierz J. Prosnak and Maciej P. Strojnowski 25 Nov. 1977 90 p refs
Avail: NTIS HC A05/MF A01

The theoretical background and a program for computing plane, steady, incompressible, and inviscid flow about an arbitrarily given system of discs is given. Cases differing only in boundary conditions are studied. The computation of the flow field is reduced to solution of a linear system of equations containing certain constant coefficients, appearing in an analytical expression for the complex velocity. The expression is assumed in the form of a suitable series of rational functions. Author

N78-23388*# Old Dominion Univ., Norfolk, Va. School of Engineering.
SIMULATION OF TURBULENT WALL PRESSURE Final Report
Robert L. Ash May 1978 45 p refs
(Grant NsG-1100)
(NASA-CR-2958) Avail: NTIS HC A03/MF A01 CSCL 20D

A Monte Carlo procedure was developed to simulate turbulent boundary layer wall pressure fluctuations. The approach utilizes much of the newly available conditional sampling information to construct the required distribution functions. Various disturbance wave forms were examined, as well as the effect of frequency-dependent decay. Good agreement between the simulation and experimental data was achieved for root mean square pressure level, power spectrum, and space time correlation. Author

N78-23389*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CONFIGURATION HEATING FOR A HYPERSONIC RESEARCH AIRPLANE CONCEPT HAVING A 70 DEG SWEPT DOUBLE-DELTA WING
Pierce L. Lawing May 1978 74 p refs
(NASA-TP-1143; L-11841) Avail: NTIS HC A04/MF A01 CSCL 20D

The heating on a candidate hypersonic research airplane configuration has been examined experimentally at Mach 6 by the phase-change-paint technique. The configuration has a double-delta wing with tip fins. Phase-change-paint diagrams give heating data for the model top, side, and bottom, with and without deflected elevons for an angle-of-attack range of 0 deg to 24 deg. Nominal Reynolds numbers are on the order of 15,000,000 with supplementary data at length Reynolds number of 4,000,000, which moves the model from the predominantly turbulent into the predominantly laminar regime. Also, intermediate Reynolds numbers were investigated on the lee side for one angle of attack. Author

N78-23390*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A NUMERICAL SOLUTION OF THE NAVIER-STOKES EQUATIONS FOR CHEMICALLY NONEQUILIBRIUM, MERGED STAGNATION SHOCK LAYERS ON SPHERES AND TWO-DIMENSIONAL CYLINDERS IN AIR
Kenneth D. Johnston and William L. Hendricks (Lockheed Missiles and Space Co., Huntsville, Ala.) May 1978 102 p refs
(NASA-TP-1227; M-254) Avail: NTIS HC A06/MF A01 CSCL 20D

Results of solving the Navier-Stokes equations for chemically nonequilibrium, merged stagnation shock layers on spheres and two-dimensional cylinders are presented. The effects of wall catalysis and slip are also examined. The thin shock layer assumption is not made, and the thick viscous shock is allowed to develop within the computational domain. The results show good comparison with existing data. Due to the more pronounced merging of shock layer and boundary layer for the sphere, the heating rates for spheres become higher than those for cylinders as the altitude is increased. Author

N78-23391# Newcastle Univ. (Australia). Dept. of Mechanical Engineering.
CONDITIONAL MEASUREMENTS IN A HEATED AXISYMMETRIC TURBULENT MIXING LAYER
K. R. Sreenivasan, R. A. Antonia, and S. E. Stephenson (Sydney Univ., Australia) 25 Jul. 1977 50 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal
Avail: NTIS HC A03/MF A01

Conditional measurements of axial velocity and temperature fluctuations are obtained in the mixing layer of a slightly heated round heated jet, which exhausts into still ambient air. The trimodal shape of the probability density function of temperature is used to distinguish between the turbulent and nonturbulent parts of the flow. A distinction is also made between the nonturbulent cold ambient fluid and the nonturbulent hot fluid of the potential core. Both velocity and temperature fluctuations associated with either hot or cold fluid are very nearly Gaussian. Fluid from the hot or cold side of the mixing layer is found on the opposite side of the mixing layer well beyond the central mixing region, suggesting bulk transport of nonturbulent fluid by a large scale motion comparable to the width of the flow. On any given side of the mixing layer, the aspect of the large scale motion which is responsible for the major contribution to the axial heat flux is the relatively infrequent motion of accelerating fluid which originates from the opposite side of the layer. Author

N78-23392# Rockwell International Corp., Columbus, Ohio. Aircraft Div.
AN INVESTIGATION OF CORNER SEPARATION WITHIN A THRUST AUGMENTER HAVING COANDA JETS Final Report, 30 Jun. 1976 - 23 Dec. 1977
Milton R. Seiler Dec. 1977 80 p refs
(Contract N62269-76-C-0402; WR02302001)
(AD-A052131; NR77H-18; NADC-76153-30) Avail: NTIS HC A05/MF A01 CSCL 20/4

An investigation was conducted to determine the way separation develops in the corners of thrust augmenter wings, having Coanda jets. Hot film surface sensors and pressure transducers were used, and the results indicated that separation on the test augmenter began at a corner very close to the augmenter exit and then rapidly proceeded upstream. Measurements of the velocity and pressure fields in the corner region indicated that a modified form of the Stratford criterion could be used to predict the onset of separation. Author (GRA)

N78-23393# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.
THREE-DIMENSIONAL INCOMPRESSIBLE BOUNDARY LAYERS ON BLUNT BODIES INCLUDING EFFECTS OF TURBULENCE, SURFACE CURVATURE AND HEAT AND MASS TRANSFER. PART 2: COMPUTER CODE USER'S MANUAL
D. L. Dwoyer, Clark H. Lewis, and P. R. Gogineni May 1977 124 p refs
(AD-A051971; VPI/SU-AERO-063-Pt-2) Avail: NTIS HC A06/MF A01 CSCL 20/4

The computer code that was developed as a result of the analysis of Part 1 of this report, VPI-AERO-063, is described and documented. Included are programs input, expected output, description of mode of operation and other information useful in running the program. GRA

N78-23394# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.
THREE-DIMENSIONAL INCOMPRESSIBLE BOUNDARY LAYERS ON BLUNT BODIES INCLUDING EFFECTS OF TURBULENCE, SURFACE CURVATURE AND HEAT AND MASS TRANSFER. PART 1: ANALYSIS AND RESULTS
D. L. Dwoyer, Clark H. Lewis, and P. R. Gogineni May 1977 74 p refs

(Contract AP/JHU-600325)
(AD-A051197; VPI/SU-AERO-063-Pt-1) Avail: NTIS HC A04/MF A01 CSCL 20/4

The governing equations for laminar, transitional and/or turbulent, incompressible, three-dimensional boundary layers are solved numerically. The equations are developed in terms of an orthogonal surface coordinate system and include surface curvature effects. The coordinates are generated numerically, while the inviscid flow is obtained from a general potential flow procedure. The only restrictions on body geometry are that it possesses a blunt nose and a plane of symmetry. The boundary-layer equations, after being transformed into similarity type variables, are solved using the implicit finite-difference Krause scheme. Various test cases are presented to establish the accuracy of the resulting computer program. Author (GRA)

N78-23395# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.
EXPERIMENTAL INVESTIGATION OF UNSTEADY SEPARATION
D. P. Telionis and C. A. Koromilas Jan. 1978 64 p refs
(Grant DAHC04-75-G-0067)
(AD-A051539; ARO-12680.4-E) Avail: NTIS HC A04/MF A01 CSCL 20/4

This is a preliminary report on a project which essentially involves the setting up of special laboratory equipment to investigate unsteady viscous phenomena and the development of appropriate methods of visualization. The present report contains only a sample of experimental results and some initial interpretations. Much more data have been collected and is now being processed. Moreover, more information is being generated beyond the schedule originally proposed. It is expected to complete this phase of the work around May of 1978 and the final report can be completed in June or July 1978. GRA

N78-23396# California Univ., Livermore. Lawrence Livermore Lab.
MODELING COMPLEX CHEMICAL REACTIONS IN FLOWS WITH TURBULENT, DIFFUSIVE MIXING
G. K. Patterson 1977 18 p refs Presented at 20th Ann. AICHE Meeting, New York, 13 Nov. 1977 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-79770; Conf-771102-17) Avail: NTIS HC A02/MF A01

Methods for modeling single chemical reactions in flows with turbulent mixing of reactants with specified or modeled degree of segregation were demonstrated. Proposals for modeling such reactions were also presented and tested for turbulent mixing in the case of turbulent diffusion over large distances. These methods generally involve some sort of algebraic closure at some level of the correlation equations to be solved. That problem is complicated by the necessity to model the growth of segregation as the components mix on a macroscale as well as its decay as components mix on a molecular scale. A method for modeling complex reactions in turbulent, diffusive mixing involves the simulation of the diffusion and mixing by coalescence-dispersion. ERA

N78-23397# Royal Aircraft Establishment, Farnborough (England).
FAST RESPONSE METERS FOR PULSED LIQUID FLOW
P. G. Herrington Jun. 1977 40 p refs
(RAE-TR-77092; BR60405) Avail: NTIS HC A03/MF A01

Two experimental solutions for the fast response measurement of small liquid expulsions are described. They were developed as part of the specialized instrumentation for hydrazine thrustor research and development. A brief summary is given of five other techniques, which were investigated but which exhibit limited performance for this particular application. Author (ESA)

N78-23398# Propellants, Explosives and Rocket Motor Establishment, Waltham Abbey (England).
SOURCES OF ERROR IN THE MEASUREMENT OF UNDERWATER SHOCK-WAVE PROPERTIES
B. L. Hammant Aug. 1977 35 p refs
(PERME-TR-15; BR58918) Avail: NTIS HC A03/MF A01

A number of possible sources of error in the determination of underwater shock wave parameters have been assessed by variance analysis. It was found that the major effect results from random variation in experimental conditions and measurement errors. Since properties are power functions of stand-off distance, the magnitudes of the errors are larger for small values of stand-off. It is shown that the pressure gages require re-calibration after experiencing shock pressures of 120 MPa. The use of the standard 0.45 kg (1 lb) TNT charge to calibrate gages was found to be a viable, though not preferred method, since it suffered from low precision. Comments on possible methods of improving resolution are given. Author (ESA)

N78-23399# Aeronautical Research Council, London (England).
THROUGH FLOW ANALYSIS OF VISCOUS AND TURBULENT FLOWS
Apostolos Goulas and Roger C. Baker 1978 32 p refs Supersedes ARC-37017
(ARC-CP-1382; ARC-37017) Avail: NTIS HC A03/MF A01; HMSO £1.75; PHI $6.75

Based on matrix through-flow analysis an attempt is made to connect the changes of entropy both to the viscous terms of the Navier-Stokes equations and to the turbulence terms of the mean flow Navier-Stokes equations, and to deduce the flow of a viscous fluid without including empirical equations for the entropy. The results of computation for straight circular pipe flows agree well with published data for laminar flow with and without swirl and for turbulent flow. Author (ESA)

N78-23400# European Space Agency, Paris (France).
STATE OF THE ART OF STUDIES ON THE DYNAMICS OF ROTATING FLUIDS, PART 1
Y. Ousset Mar. 1978 46 p refs Transl. into ENGLISH from ESA Journal (Paris), v. 1, no. 1, 1977 p 43-70 Original report in FRENCH previously announced as A77-36228
(ESA-TT-440) Avail: NTIS HC A03/MF A01

A bibliographical review of studies conducted in the field of rotating fluid dynamics is presented, with special emphasis on applications to tip-dampers and on evaluation of the dissipation due to fluid movement against the tank walls. The following topics are covered: an analytical study of the problem equations; experimental studies for evaluating the fluid dissipation; numerical resolution of Navier-Stokes equations and subsequent applications to rotating fluids; and problems related to surface tensions at interfaces when the fluid is under low gravity. The conclusions point out various possible approaches which might be used to tackle the different problems. Author (ESA)

N78-23401# European Space Agency, Paris (France).
STATE OF THE ART OF STUDIES ON THE DYNAMICS OF ROTATING FLUIDS, PART 2
Y. Ousset Mar. 1978 29 p refs Transl. into ENGLISH from ESA Journal (Paris), v. 1, no. 2, 1977 p 189-208 Original report in FRENCH previously announced as A77-48656
(ESA-TT-443) Avail: NTIS HC A03/MF A01

A bibliographical review of studies conducted in the field of rotating fluid dynamics is presented, with special emphasis on applications to tip-dampers and on evaluation of the dissipation due to fluid movement against the tank walls. The following topics are covered: an analytical study of the problem equations; experimental studies for evaluating the fluid dissipation; numerical resolution of Navier-Stokes equations and subsequent applications to rotating fluids; and problems related to surface tensions at interfaces when the fluid is under low gravity. The conclusions point out various possible approaches which might be used to tackle the different problems. Author (ESA)

N78-23402 National Technical Information Service, Springfield, Va.
FLUID CONTROL DEVICES, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1972 - Feb. 1978
Guy E. Habercom, Jr. Feb. 1978 257 p Supersedes NTIS/PS-77/0181; NTIS/PS-76/0140 and NTIS/PS-75/205 (NTIS/PS-78/0189/7; NTIS/PS-77/0181; NTIS/PS-76/0140; NTIS/PS-75/205) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 13G

The design, fabrication, application, and performance of fluidic and flueric control devices are described in these Government-sponsored research reports. GRA

N78-23403 National Technical Information Service, Springfield, Va.
FLUID CONTROL DEVICES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1974 - Feb. 1978
Guy E. Habercom, Jr. Mar. 1978 322 p Supersedes NTIS/PS-77/0182 and NTIS/PS-76/0141
(NTIS/PS-78/0190/5; NTIS/PS-77/0182; NTIS/PS-76/0141) Avail: NTIS HC $28.00/MF $28.00 CSCL 13G

The design, fabrication, application, and performance of fluidic and flueric control devices are described in these abstracts of reports gathered in a worldwide literature survey. GRA

N78-23404 National Technical Information Service, Springfield, Va.
CAVITY FLOW. VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1971 - Feb. 1978
Guy E. Habercom, Jr. Mar. 1978 209 p Supersedes NTIS/PS-77/0034; NTIS/PS-76/0041
(NTIS/PS-78/0188/9; NTIS/PS-77/0034; NTIS/PS-76/0041) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 20D

Citations on shallow and deep configurations, holes, cutouts, hollows, notches, gaps, orifices, flaps, and steps are presented. Applications covered include bomb bays, aerodynamic windows, microwave cavities, resonators, bearings, diffusers, and jets. This updated bibliography contains 204 abstracts. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N78-23405# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
REAL-TIME ACOUSTICAL HOLOGRAPHY SYSTEMS
Virgil G. Irelan, Bobby R. Mullinix, and John G. Castle Oct. 1977 61 p refs
(DA Proj. 1L3-62303-A-214)
(AD-A052000; DRDMI-T-78-10) Avail: NTIS HC A04/MF A01 CSCL 14/5

The existing system for Acoustical Real Time Holographic Image Reproduction is described, together with operating instructions. Its novel features include: (1) large diameter (approximately 4 in.) ultrasonic beam and correspondingly large image area; (2) high intensity of the ultrasonic beam and therefore, improved penetrability for thick test objects; and (3) excellent damping in the water tanks and therefore, less background noise during real time viewing. Preliminary nondestructive testing measurements indicate that the system resolution is close to the theoretical diffraction limit for the acoustical wavelengths (in the water medium) of 0.3, 0.5, and 1.5 mm. For discerning flaws in samples with high internal scattering, the real-time feature is necessary. For highly reflecting test objects, an improvement in penetration has been demonstrated using a coating to reduce the reflection coefficient of the test object. Preliminary data are presented using 3 MHz beams through ceramic and foam test plates with the images recorded photographically. The Acoustical Real Time Holographic Image Reproduction system is ready to be tested as a nondestructive testing method for flaws in silica radomes. Author (GRA)

N78-23406# California Univ., Livermore. Lawrence Livermore Lab.
ELECTRIC AND MAGNETIC SENSING SYSTEMS: APPLICATIONS
F. Chilton (Science Applications, Palo Alto, Calif.), L. Wood, and R. Buntzen (Naval Ocean Systems Center, San Diego, Calif.) Sep. 1977 42 p
(Contract W-7405-eng-48)
(UCID-17597) Avail: NTIS HC A03/MF A01

The underlying principles of electric and magnetic sensing were reviewed. Recent advances in the associated technologies are discussed and some insight into the use of such systems in ocean surveillance was provided. ERA

N78-23407# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
CONTRIBUTION TO THE EXPERIMENTAL INVESTIGATION AND APPLICATION OF HOT FILM SONDES M.S. Thesis - Goettingen Univ., West Ger. [BEITRAEGE ZUR EXPERIMENTELLEN UNTERSUCHUNG UND ANWENDUNG VON HEISSFILMSONDEN]
H. Klages Jul. 1977 85 p refs In GERMAN
(MPIS-14/1977) Avail: NTIS HC A05/MF A01; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 14,85

Two independent test methods were used to determine the directional behavior of several cylindrical hot film sondes. The frequency response of a transducer element was determined in a pipe flow. Longitudinal fluctuations of wall flow velocity were investigated in a turbulent pipe flow in the Re number range between 7000 and 18000 using the transducer element. ESA

N78-23408# Centre National d'Etudes Spatiales, Toulouse (France).
SURVEY OF MAGNETIC TAPE RECORDING TECHNIQUES [REVUE DES TECHNIQUES D'ENREGISTREMENT MAGNETIQUE SUR BANDE]
A. J. Job Paris ESA Dec. 1977 219 p refs In FRENCH
(Contract ESTEC-2899/76-NL-HP)
(ESA-CR(P)-1026) Avail: NTIS HC A10/MF A01

Magnetic tape recording technologies are reviewed, in particular those which are of use onboard earth observation satellites. Theoretical aspects and basic techniques are dealt with, and several types of recorders and their typical performances are described. Requirements of onboard recorders as a function of mission type are outlined, indicating the necessity for digital recording, storage capabilities of several G bits, and transfer rates of several tens of M bits/sec. Available U.S. and European products are reviewed. The draft specifications of a spaceborne data recorder are given. ESA

N78-23409# Engins Matra, Velizy (France). Lab. de Traitement des Images.
STUDY OF IMAGE ON-BOARD PROCESSING METHODS
Gabriel E. Lowitz and Alain G. Spiwack Paris ESA 15 Dec. 1977 216 p refs
(Contracts ESTEC-2898)
(Rept-60/382; ESA-CR(P)-1031) Avail: NTIS HC A10/MF A01

Image data compression techniques that could be implemented onboard satellites were studied. Classical image processing techniques considered are digital pulse code modulation systems, run length coding systems, transform coding, and syntactic coding. Theoretical aspects include natural dimension reduction and Karhunen-Loeve preprocessing; structure of black and white and multispectral images; syntactic data compression by class extraction; and Matra clustering algorithm. Onboard implementation and simulation results are discussed. In annexes a clustering technique based on the partitioning of the data histogram, stability and dimensionality of Karhunen-Loeve multispectral image expansions, and an iterative procedure for the KL transform of a sequence of adjacent data blocks are presented. ESA

N78-23410# National Physical Lab., Teddington (England).
A LASER-PISTONPHONE FOR ABSOLUTE CALIBRATION OF LABORATORY STANDARD MICROPHONES IN THE FREQUENCY RANGE 0.1 Hz TO 100 Hz
A. J. Rennie Apr. 1977 39 p refs
(NPL-Ac-82) Avail: NTIS HC A03/MF A01

A new instrument, based on the well-known pistonphone principle, was designed, and a prototype was constructed and tested, to provide absolute calibration of laboratory standard microphones at frequencies in the range 0.1 Hz to 100 Hz. The instrument utilizes the reciprocating motion of a piston in a rigid-walled enclosure to generate a sound pressure whose amplitude depends on the displacement of the piston. Accurate measurement of piston displacement is achieved by means of a Michelson interferometer using a laser source and the instrument

is termed a laser-pistonphone. The performance of the prototype instrument was validated by comparison with the internationally standardized precision method, which uses the reciprocity technique, for a representative group of standard microphones and it was found to yield a comparable precision. Author (ESA)

N78-23411# National Bureau of Standards, Washington, D. C.
CALIBRATION OF TIME RESPONSE OF THERMOMETERS: CONCEPTS AND MODEL CALCULATIONS Final Report
Raymond D. Mountain and G. W. Mulholland Jan. 1978 38 p refs
(PB-276395/1; NBS-TN-959) Avail: NTIS HC A03/MF A01 CSCL 14B

A time response function is discussed which characterizes the way a given sensor responds to changes in the temperature of its surroundings. A series of model calculations of the response function for idealized sensors were used to investigate the general features of the response functions. Important features were the sensitivity of these functions to: (1) material properties of the sensor, (2) the type of thermal coupling of the sensor with the environment, and (3) the geometry of the sensor. These features must be considered in the design of procedures for calibrating the time response of thermometers. GRA

N78-24035# Joint Publications Research Service, Arlington, Va.
MEASURING SELSYN ROTOR ANGLE OF ROTATION CONVERTER
T. M. Aliyev, R. M. Mirsalimov, and V. B. Ibragimov *In its* Transl. on USSR Sci. and Technol. (JPRS-71181) 25 May 1978 p 23-26 refs Transl. into ENGLISH from Izv. Vysshykh Uchebn. Zavedenii Priborostr. (Leningrad), vol. 21, no. 2, 1978 p 5-8 (For availability see N78-24033 14-99)
Copyright. Avail: Issuing Activity

N78-24036# Joint Publications Research Service, Arlington, Va.
THE EFFECT OF LINEAR ACCELERATION ON THE STABILITY OF A DYNAMICALLY TUNED PRECESSION GYROSCOPE
V. A. Kuzinov *In its* Transl. on USSR Sci. and Technol. (JPRS-71181) 25 May 1978 p 27-32 refs Transl. into ENGLISH from Izv. Vysshykh Uchebn. Zavedenii Priboroster. (Leningrad), vol. 21, no. 2, 1978 p 72-76 (For availability see N78-24033 14-99)
Copyright. Avail: Issuing Activity

36 LASERS AND MASERS

Includes parametric amplifiers.

N78-23412 Texas Univ., Dallas.
CONVERSION EFFICIENCY OF THE NITROGEN ION ELECTRIC DISCHARGE LASER Ph.D. Thesis
Kenneth Neal Taylor 1978 226 p
Avail: Univ. Microfilms Order No. 78-07102

The primary concern of this dissertation is to describe the construction and operation of the electric discharge nitrogen-ion laser. The high pressure requirements of the laser demand the incorporation of a preionizing element of preparing the gas for the main discharge. The circuitry utilized for accomplishing this task is that of a cable transformer which is charged and discharged in a manner similar to that of the Marx generator. The theory of operation of the transformer including both its input and output behavior is presented in such a manner as to acquaint the reader with the more practical aspects of the device. Dissert. Abstr.

N78-23413 State Univ. of New York, Stony Brook.
LASER BRILLOUIN SCATTERING IN TETRAHALIDE LIQUIDS Ph.D. Thesis
Kuo-ching Liu 1978 110 p
Avail: Univ. Microfilms Order No. 78-05788

An inelastic optical scattering of Brillouin spectra from thermal fluctuations in tetrahalide liquids was investigated. These spectra were excited with a single-mode Argon - ion laser and analyzed with a piezo-electric scanned Fabry-Perot spectrometer and photocounting techniques. An asymmetrical intensity profile of the Brillouin components due to a new component other than Rayleigh and Brillouin components was observed. A method of evaluation of the effective parameter in Lennard-Jones potential function of these liquids was obtained. By analyzing and comparing the integrated intensity of the Brillouin components with that of a reference liquid, the acousto-optic constant of liquids was determined. Dissert. Abstr.

N78-23414 Ohio State Univ., Columbus.
AN INVESTIGATION OF FLASHLAMP PUMPED DYE LASERS Ph.D. Thesis
Paul Francis McManamon 1977 233 p
Avail: Univ. Microfilms Order No. 7805888

During this investigation, flashlamp pumped dye lasers were thoroughly examined. This investigation included: (1) a rate equation analysis of dye lasers, (2) an investigation of the optical quality of the dye medium in a flashlamp pumped dye laser, (3) an examination of the influence of various triplet quenchers on laser output, (4) an investigation of the influence of a shockwave on laser pulse termination, (5) a discussion of the optimum switching configuration for use in cavity dumping a flashlamp pumped dye laser, (6) an investigation of cavity dumping, (7) a reduction of internal cavity loss by a factor of two or more, (8) a stable resonator design which allowed relatively efficient laser operation while obtaining resonable beam divergence, and (9) a brief study of the possibility of a phosphorescent dye laser. Each of the above areas, plus some additional minor areas, are discussed in the dissertation. Dissert. Abstr.

N78-23415# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
LASER-GENERATED STRESS WAVES IN LIQUIDS Ph.D. Thesis
Markus W. Sigrist 1977 101 p refs
(ETH-5985) Avail: NTIS HC A06/MF A01

The devices used for the investigations are described. Subsequently, the experimental results obtained for water, n-heptane, and carbon tetrachloride are discussed. Individual contributions of the vaporization and of the thermoelastic effect on the stress generation are outlined in detail. Most important for the phenomenon of generation of the stress waves is the amount of the absorbed laser energy density in comparison to the vaporization threshold of the liquid. The influence of the laser pulse characteristics is emphasized for the example of tunable high frequency, acoustic waves. These waves are generated by the impact of a self mode-locked laser pulse. Author

N78-23416# Princeton Univ., N. J. Plasma Physics Lab.
MEASUREMENTS OF THE PARAMETRIC DECAY OF CO2 LASER RADIATION INTO PLASMA WAVES AT QUARTER CRITICAL DENSITY USING RUBY LASER THOMSON SCATTERING
J. J. Schuss, T. K. Chu, and L. C. Johnson Nov. 1977 16 p refs
(Contract EY-76-C-02-3073)
(PPPL-1394) Avail: NTIS HC A02/MF A01

The results of small angle ruby laser Thomson scattering measurements of the parametric excitation of plasma waves by CO2 laser radiation at quarter critical density in a laser heated gas target plasma are reported. From supplementary data obtained from interferometry and large angle ruby laser scattering it is inferred that the threshold conditions for a convective decay are satisfied. Author

N78-23417# Mathematical Sciences Northwest, Inc., Bellevue, Wash.
KINETIC STUDIES FOR XeF AND KrF LASERS Final Technical Report
R. E. Center and C. H. Fisher 31 Jan. 1978 34 p refs
(Contract N00014-76-C-1066; DARPA Order 1806)
(AD-A051656; MSNW-78-1062) Avail: NTIS HC A03/MF A01 CSCL 20/5

A state-selective laser-induced-fluorescence technique has been used to determine the radiative lifetime and collisional quenching kinetics for the XeF (B 1/2) excited state. Ground state XeF molecules, formed by flash dissociating a mixture of UF6 and Xe diluted in He, are excited to the B state by a

3511 A XeF laser pulse. The subsequent fluorescence decay of the v = 0 level is monitored at 3533 A using a spectrometer-fast photomultiplier combination. Collisional quenching rate coefficients for the collision partners He, Ne, Xe, F2, and NF3 are reported. Broadband fluorescence emission at 460 nm has also been observed and is interpreted to result from collisional transfer from the B to the C state of XeF. Author (GRA)

N78-23418# Boeing Co., Seattle, Wash.
FEASIBILITY OF CUTTING ALUMINUM ALLOYS WITH A 6-KILOWATT LASER Final Report, Mar. 1976 - Mar. 1977
Devere Lindh Sep. 1977 55 p
(Contract F33615-76-C-5275)
(AD-A051838; AFML-TR-77-66) Avail: NTIS HC A04/MF A01 CSCL 13/8

The results of this program demonstrated that it is feasible to use laser cutting of aluminum without edge enhancement in the fabrication of hardware where a sheared or blanked edge is acceptable to meet engineering requirements. However, it was further shown that it is not feasible to use an as-laser-cut edge for hardware where machined edges or hole filling fasteners are required to meet engineering requirements. Author (GRA)

N78-23419# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.
THE PARALLEL INTERNAL-MASTER-OSCILLATOR POWER-AMPLIFIER FOR PHASE MATCHING THE OUTPUT BEAMS OF MULTI-LINE LASERS Interim Report
Walter R. Warren, Jr. 16 Feb. 1978 22 p
(Contract F04701-77-C-0078)
(AD-A052037; TR-0078(9990)-6; SAMSO-TR-78-50) Avail: NTIS HC A02/MF A01 CSCL 20/5

A conceptual device optics system is discussed, which, in principle, allows combining, on a large mirror, the multiline outputs of an arbitrary number of separate laser devices. In principle, each lasing transition from each laser will be in phase with the corresponding transition from the other laser devices that illuminate the other parts of the mirror. This will be true even if the multiline lasing transitions fluctuate rapidly (go on and off). The concept involves the use of several equal size laser segments, possibly arranged in a polygon configuration for compactness. One segment is run as an oscillator; its output is split into a number of beams, which are used to drive the other laser segments as amplifiers. Because of the multiline nature of the laser mechanism, the basic requirement of the system is that the absolute lengths of the paths through the amplifiers from the oscillator output mirror to the large collecting mirror be equal. In this report, the concept is developed in its simplest form; however, it should be compatible with both adaptive optics beam control (multisection movable mirrors) and techniques to correct beam steering caused by anomalous dispersion or by other effects. Author (GRA)

N78-23420# Avco-Everett Research Lab., Everett, Mass.
ELECTRON-BEAM SUSTAINER DISCHARGE STREAMERS AND ARCING Final Report, 1 Dec. 1974 - 30 Nov. 1977
D. H. Douglas-Hamilton and P. S. Rostler Nov. 1977 80 p refs
(Contract F44620-75-C-0025)
(AD-A051987; AFOSR-78-0354TR) Avail: NTIS HC A05/MF A01 CSCL 20/9

The electron beam sustainer method of generating a stable high pressure gas discharge is investigated theoretically and experimentally. The most important discharge instability in the non-self-sustaining discharge is the streamer; this is discussed and a model proposed for formation and propagation. Integration of streamer velocity over the discharge gap predicts arcing times. Experimental measurements of streamer behavior in nitrogen discharge have been made, and these are compared with predictions. Comparisons in other gas mixtures and various electron-beam sustainer discharge devices have also been made. Author (GRA)

N78-23421# Naval Weapons Center, China Lake, Calif.
PULSED HF/DF LASER DAMAGE IN WINDOW MATERIALS
M. J. Soileau, E. W. Vanstryland, M. Bass, and C. C. Tang Dec. 1977 17 p refs Presented at 9th Boulder Damage Symp. on Mater. for High Power Lasers, 4-6 Oct. 1977, Boulder, Colo.
(AD-A051140; NWC-TR-1-ONR) Avail: NTIS HC A02/MF A01 CSCL 20/5

Laser damage thresholds are reported for several alkali-halides, alkaline earth fluorides, ZnSe, As2S3, sapphire, spinel and quartz at HF (2.7 micrometers) and DF (3.8 micrometers) wavelengths. A low pressure, transversely excited, double discharge laser and two different focal length lenses were used. A Gaussian spatial beam distribution was obtained by spatially filtering out high order modes in the far field of an unstable resonator cavity. Sapphire was found to have the highest bulk damage threshold of the materials tested, 100 GW/sq cm at 2.7 micrometers (peak intensity on axis). The damage threshold was found to vary as the inverse of the spot diameter. The measurements also show that all of the materials evaluated in this effort are surface damage limited when exposed to pulsed HF or DF laser radiation. Evidence concerning the roles of material manufacture, surface finishing and laser irradiation conditioning in the damage process are presented. GRA

N78-23422# Naval Weapons Center, China Lake, Calif.
MULTITHRESHOLD MEASUREMENT AND ANALYSIS OF PULSED LASER DAMAGE ON OPTICAL SURFACES
J. O. Porteus, J. L. Jernigan, and W. N. Faith Dec. 1977 14 p refs Presented at the 9th Boulder Damage Symp. on Mater. for High Power Lasers, Boulder, Colo., 4-6 Oct. 1977
(RR0220202)
(AD-A051141; NWC-TR-2-ONR; ONR-TR-2) Avail: NTIS HC A02/MF A01 CSCL 20/5

The methodology of multithreshold analysis, a new approach to laser-damage research, is described. The comparison of thresholds for various damage-related effects identifies dominant failure mechanisms and provides better guidance for laser-materials technology. After a brief description of apparatus, the procedure for routinely measuring up to eight different thresholds per sample is given. The maximum-likelihood principle is used to derive an algorithm for computing thresholds and standard deviations. The use of a standard gold sample to verify reproducibility and to maintain long-term calibration is discussed. Examples of multithreshold results on uncoated and coated infrared optical components are presented. The following are some of the effects for which thresholds are compared: slip, roughening, cracking, pits, melting, craters, delamination of coatings, ion and light emission, and work function change. Author (GRA)

N78-23423# ARO, Inc., Arnold Air Force Station, Tenn.
EXPERIMENTAL LASER ATTENUATION IN A SNOW ENVIRONMENT Final Report, 24 Jan. - 4 Sep. 1977
John T. Miller AEDC Mar. 1978 85 p refs
(AD-A051586; AEDC-TR-77-99) Avail: NTIS HC A05/MF A01 CSCL 20/5

Laser transmission through a snowfield has been measured in a laboratory experiment. Simultaneous measurements of the attenuation of a 0.6328 and a 10.6 micrometer wavelength laser beam by a common snowfield are reported. The results are favorably compared with a prediction of an analytic model which treats the snowflakes as spheres. The analytic model is then restructured and applied to predict the attenuation which would be obtained in a natural snowfield. Author (GRA)

N78-23424# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
METHODS FOR PREDICTION OF ATMOSPHERIC EFFECTS ON LASER GUIDANCE SYSTEMS
J. Q. Lilly 15 Nov. 1977 44 p refs
(DA Proj. 1L1-62303-A-214)
(AD-A051617; DRDMI-T-78-16) Avail: NTIS HC A03/MF A01 CSCL 04/1

This report describes mathematical models which predict effects of atmospheric turbulence, molecular absorption and scattering, aerosol absorption and scattering, and radiative transport. Turbulence-induced angle-of-arrival fluctuations of a laser target designator are formulated to permit calculation of the fluctuation power spectrum. A numerical procedure employing the fast Fourier transform is used to convert the frequency-dependent power spectrum into the time domain giving angular beam wander. A separate computation gives the angular

beamspread due to atmospheric turbulence. Descriptions of other models to determine molecular line absorption and aerosol absorption and scattering are also given. Models developed during this effort also provide first-order radiative transfer predictions and a multiple scattering model using Monte Carlo predictions. Utilization instructions are included for each of the models.
Author (GRA)

N78-23425# California Univ., Livermore. Lawrence Livermore Lab.
ENERGY BALANCE MEASUREMENTS FOR SHIVA
S. S. Glaros, V. C. Rupert, S. R. Gunn, D. W. Phillion, and H. N. Kornblum 1977 23 p refs Presented at Ann. Amer. Phys. Soc. Meeting, Atlanta, 7 Nov. 1977
(Contract W-7405-eng-48)
(UCRL-79801; Conf-771136-12) Avail: NTIS HC A02/MF A01

The Shiva laser target interaction facility is designed for experiments at 20 to 30 terawatts. At this power level there will be larger fluxes of neutrons, X-rays, electrons and ions. The measurements of energy converted into the various reaction products is crucial both in target design and performance analysis of the actual experiment. The total energy absorbed was measured by a box calorimeter surrounding the target except for beam input holes. This measurement prevents the use of other diagnostics, so for normal operation an energy balance module was designed for location on ports on the Shiva target chamber. The module monitors the energy in scattered light at 10640 A and 5320 A or 7118 A. It also contains a Faraday cup and plasma and X-ray calorimeters. The distribution of energy in scattered light, plasma and X-rays will be mapped by 58 such modules. ERA

N78-23426# California Univ., Livermore. Lawrence Livermore Lab.
AUTOMATIC ALIGNMENT SYSTEM FOR THE TWENTY BEAM SHIVA FUSION LASER
E. S. Bliss, F. W. Holloway, and E. H. Dryden 1977 17 p Presented at Electro-optical Systems Conf., Anaheim, Calif., 25 Oct. 1977
(Contract W-7405-eng-48)
(UCRL-80249; Conf-771040-7) Avail: NTIS HC A02/MF A01

The following are described: oscillator/preamp alignment; chain input pointing; spatial filter pinhole alignment; output pointing, focusing, and centering system; and alignment controls. ERA

N78-23427# Lincoln Lab., Mass. Inst. of Tech., Lexington.
EFFICIENT THIRD HARMONIC GENERATION OF CO2 LASER RADIATION IN LIQUID CO-O2-SF6 MIXTURES
Helge Kildal and R. J. Brueck 1978 6 p ref Presented at Topical Meeting on Inertial Confinement Fusion, San Diego, Calif., 7 Feb. 1978 Sponsored in part by AF
(Contract ES-77-S-02-4251)
(COO-4251-5; Conf-780202-10) Avail: NTIS HC A02/MF A01

A tripling efficiency of 2% is reported for the CO2 R(6) line at 9.35 micrometers. Processes that may potentially limit the conversion efficiency are discussed. ERA

N78-23428# Westinghouse Electric Corp., Pittsburgh, Pa. Research and Development Center.
LASER DISCHARGES IN ATTACHING GASES Final Report, 25 Jun. 1976 - 24 Jun. 1977
G. L. Rogoff, L. E. Kline, J. L. Pack, and W. H. Kasner Sep. 1977 67 p refs
(Contract EY-76-C-02-4030)
(COO-4030-4) Avail: NTIS HC A04/MF A01

A significant problem in the development of high power gas discharge lasers is the glow to arc transition, which limits the electrical energy that can be deposited in the diffuse glow plasma, especially in attaching gases. A combined experimental and theoretical study of the maintenance and stability of glow discharges in attaching gas mixtures similar to those used in rare gas halide excimer laser discharges is described. A discharge test apparatus was constructed for establishing UV-preionized, self sustained, diffuse glow discharges in halogen containing mixtures. Quasi-steady, diffuse discharges were established in 0.5% SF6:15-15% Kr:He mixtures at 100-800 Torr, and were maintained for up to 1 micron sec, the limit of the pulse forming network used. Measured electric fields in the positive column agree well with fields calculated from a steady state model based on electron production by one and two step electron impact ionization. ERA

N78-23429# Hughes Aircraft Co., Culver City, Calif. Electro-Optical and Data Systems Group.
LASER PUMP DEVELOPMENT Final Report
Jun. 1977 22 p refs Sponsored by ERDA
(UCRL-13762) Avail: NTIS HC A02/MF A01

Technology concepts for increasing the efficiency of high power laser dye pumps and the use of the YAG laser as a source of the high frequency (0.53 micron) pump radiation include operating a high efficiency frequency doubling (FD), 1.06 to 0.53 micron unit in a high average power mode that high frequency green outputs suitable for dye laser pumping can be produced. A 20 W average power per port for 6 h of operating time, amplitude uniformity that holds variations in pulse energy to less than 5% of the average pulse energy and beam pointing stability of 250 micron radians. The delivery of 35 watts average output power was demonstrated. Electrical efficiency was 0.5%. The beam divergence remained at 7 milliradians for the entire operating period. Pulse repetition rates are variable from 10 to 20 rate. ERA

N78-23430# Addis Translations International, Portola Valley, Calif.
HIGH-SPEED IMAGE CONVERTERS FOR STUDYING LASER RADIATION WITH PICOSECOND AND FEMTOSECOND TIME RESOLUTION
G. I. Bryukhnevich, H. S. Vorobev, and M. Ya. Schelev Nov. 1977 23 p refs Transl. into ENGLISH of Preprint-31 from Fiz. Inst. im. P. N. Lebedeva, Akad. Nauk SSSR, Moscow, 1977 23 p Sponsored by DOE Prepared for California Univ., Livermore. Lawrence Livermore Lab.
(UCRL-Trans-11298; Preprint-31) Avail: NTIS HC A02/MF A01

On the basis of the experiments performed and theoretical estimates, the chief methods for modernizing multistage image converters (IC) of type PIM-UMI in the direction of an appreciable increase of their time and space resolution in the linear scanning mode were formulated. The principal models of high speed IC used for studying lasers and laser plasma are described. The method of recording sinusoidally modulated laser radiation for measuring the dynamic characteristics of IC were developed further. Specific features of the circuits of dual frequency neodymium lasers are discussed. Individual results of measurement of the temporal modulation transfer function of the converters studied are presented. Plans for further improvement of high-speed IC were outlined. ERA

N78-23431# Chalmers Univ. of Technology, Goteborg (Sweden). School of Electrical Engineering.
ACOUSTO-OPTICAL MODULATION AND HETERODYNE DETECTION OF LASER LIGHT WITH APPLICATIONS Ph.D. Thesis
Hans Eklund Apr. 1977 109 p refs
(CTH-TR-71) Avail: NTIS HC A06/MF A01

The sensitivity of an optical heterodyne system with a HgCdTe photodiode as detector was examined. Some novel approaches to the problem were made such as using an acousto-optical modulator at the same time both as a frequency shifter and a precision optical attenuator. The minimum detectable power was found to be very close to the theoretical limit. The maximum systematic fractional error of the measured values is estimated to be 29 percent. Some new concepts of modulating and detecting laser radiation at 1.6 micron in communication systems are reported. They are based upon principles of the acoustooptical effect as well as heterodyne reception. The feasibility of the system was demonstrated by transmission of a color television picture over an atmospheric link with a path length of 120 m. A study of the chopper signal distortion due to beam-pointing error in long distance laser links was performed. The pulse shape of the detected signal at the receiver depends

on the misalignment of the laser beam. Computer simulations verify the experimental results. Author (ESA)

N78-23432# European Space Agency, Paris (France).
EXPERIENCES WITH THE ASSESS 2 LIDAR EXPERIMENT
C. Werner, H. Herrmann, and F. Koepp Mar. 1978 76 p Transl. into ENGLISH of 'Erfahr. aus dem ASSESS 2 Lidar-Expt.', DFVLR, Oberpfaffenhofen, West Ger. Report DLR-IB-553-77/6, 7 Oct. 1977 Original report in GERMAN previously announced as N78-18296
(ESA-TT-458; DLR-IB-553-77/6) Avail: NTIS HC A05/MF A01

The Lidar experiment on the second ASSESS (Airborne Science Spacelab Experiments System Simulation) flight in May 1977 at Ames Research Center is discussed. Light pulses in the wavelength range of 1.06 micrometer from an Nd glass laser were transmitted vertically downwards and the backscattered radiation from the earth and from atmospheric particles were received on a radiation detector by means of a parabolic mirror. It was found that for a Spacelab mission only experiments can be used that have been tested for a long time onboard an aircraft and that operate nearly completely automatically. ESA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N78-23433 Wisconsin Univ., Madison.
DESIGN OF A SIGNATURE ANALYSIS SYSTEM FOR PRODUCT AND MACHINERY CONDITION MONITORING Ph.D. Thesis
William Harlan Dornfeld 1977 233 p
Avail: Univ. Microfilms Order No. 7728243

The complete development of an acoustical signature analysis system for refrigerators is presented. The performance and variability of the system are studied, and an example of a simplified go/no-go test is given. In addition, a machinery monitoring system for determining cutting conditions of a vertical milling machine is developed, using spindle torque as the measured signal.
Dissert. Abstr.

N78-23434*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METHOD AND APPARATUS FOR HOLDING TWO SEPARATE METAL PIECES TOGETHER FOR WELDING Patent Application
Sidney R. McClure, inventor (to NASA) Filed 6 Apr. 1978 18 p
(NASA-Case-GSC-12318-1; US-Patent-Appl-SN-894213) Avail: NTIS HC A02/MF A01 CSCL 13I

An invention is presented which relates generally to a method and apparatus for holding two separate overlapping metal pieces together under constant and equal pressure so that no air pockets form between the overlapping portions which would prevent proper welding. NASA

N78-23435# Rovac Corp., Rockledge, Fla.
ROTARY VANE POSITIVE DISPLACEMENT AIR CYCLE MACHINE FOR ARMY ECS APPLICATIONS
Aug. 1977 170 p refs
(Contract DAAG53-76-C-0052)
(AD-A051623) Avail: NTIS HC A08/MF A01 CSCL 13/7

This report presents the results of laboratory tests and calculations conducted on a Model 606 air conditioning system designed for U.S. Army Mobile applications. The specified test conditions were as follows: an outside or sink temperature of 125 F, and inside or cooling load conditions of 90 F dry bulb and 67 F wet bulb. The results of performance testing a steady state cooling capacity of 7200 Btu/hr at a COP of 0.544 was measured during testing. This performance compares favorably with an overall COP on the order of 0.35 produced by well-developed conventional air cycle turbo-machine and air cycle system technology. Also included in this report are calculations predicting the performance of this Model 606 compressor-expander with ports designed to minimize port losses and internal thermal barriers to minimize adverse intra-Circulator heat transfer. GRA

N78-23436# Rovac Corp., Rockledge, Fla.
ROTARY VANE POSITIVE DISPLACEMENT AIR CYCLE MACHINE FOR ARMY ECS APPLICATIONS Final Technical Report
W. R. Bomstad and W. R. Sanders Sep. 1977 71 p refs
(Contract DAAG53-76-C-0052)
(AD-A051622) Avail: NTIS HC A04/MF A01 CSCL 13/7

This report documents an exploratory research and development program to design, fabricate, and test an engineering demonstration prototype positive-displacement rotary-vaned air cycle machine (Model 606) for the United States Army Mobility Equipment Research and Development Command at Ft. Belvoir, Virginia. Existing ROVAC computer software was used to perform system analysis and to establish machine design parameters. The Model 606 compressor-expander (Circulator) was fabricated using conventional means and special techniques developed by The ROVAC Corporation. The Circulator and the associated air conditioning system evolved through modifications from an open cycle system design to a closed cycle system with regeneration. These changes in the system configuration and modifications in circulator design were performed to incorporate into the 606 breadboard system all promising improvements which are continuously derived from ROVAC's internally funded advanced development programs. GRA

N78-23437# Mechanical Technology, Inc., Latham, N. Y.
MECHANICS OF ROLLER INSTABILITY IN ROLLER BEARINGS Final Report, 1 Feb. - 31 Oct. 1977
Pradeep K. Gupta Jan. 1978 69 p refs
(Contract DAAG29-77-C-0014)
(AD-A051541; MTI-78TR10; ARO-14445.1-E) Avail: NTIS HC A04/MF A01 CSCL 13/9

An analytical formulation for the roller motion in a cylindrical roller bearing is presented in terms of the classical differential equations of motion. Roller-race interaction is analyzed in detail and the resulting force and moment vectors are determined. Formulation for the roller end and race flange interaction during skewing of the roller is also considered. Elastohydrodynamic traction models for the turbo-33 type oil, 5P4E polyphenyl ether, and the MIL-L-7808 oil are summarized for the purpose of computing roller/race traction. The nature of the general motion of the roller is investigated by integrating the equations of motion for a typical roller bearing. It is found that very high frequency vibrations in the roller motion result from the roller/race contact resonance. Author (GRA)

N78-23438# Boeing Vertol Co., Philadelphia, Pa.
ENGINEERING SERVICES TO CONDUCT QUALIFICATION TESTING OF PRECISION FORGED SPIRAL BEVEL GEARS Final Report, Jul. 1974 - Oct. 1977
Raymond J. Drago Oct. 1977 63 p
(Contract DAAJ01-74-C-1052)
(AD-A051542; D210-11142-1; USAAVRADCOM-76-45) Avail: NTIS HC A04/MF A01 CSCL 13/9

This report presents the results of a program to evaluate the relative surface load capacity of CH-47C transmission spiral bevel gears manufactured by the integrally forged method (forged and ground) as compared to conventional current production gears (cut and ground). A three phase test program was conducted. Phase 1 included the deflection test of one set of conventional baseline gears and rotating load tests of two sets each of the integrally forged and conventional baseline gears. All gears were run at torque levels equivalent to 50,100, and 150 percent of the CH-47C single engine rating. Phase 2 included rotating load tests of two additional conventional based line and five additional integrally forged gear sets in the Boeing Vertol test stand at loads of 100 to 130 percent of single engine rating for 340 hours. Phase 3 involved extended surface-fatigue testing of four precision integrally forged gear sets in the test stand at 100 percent of single engine rating for 800 hours. The results of this testing indicate that the surface-load capacity of the integrally forged gear sets is at least equivalent to that of the conventional baseline gears. Author (GRA)

N78-23439# Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.
STABILIZATION OF ESSENTIAL ROTATING MACHINERY FOR THE FOSSIL FUEL INDUSTRY Annual Report, Aug. 1976 - Aug. 1977
D. W. Lewis and P. E. Allaire Nov. 1977 91 p refs
(Contract EX-76-C-01-2479)
(FE-2479-1) Avail: NTIS HC A05/MF A01

Research was reported on machinery performance, machinery design and criteria, preventive maintenance, computer programs for analysis of rotating machinery and rotor dynamics measurements. Author (ERA)

N78-23440# Oak Ridge National Lab., Tenn.
REPORT OF SURVEY OF VALVE INDUSTRY CAPABILITIES
W. A. Bush and E. C. Slade 1977 24 p refs Presented at Workshop on Valves for Solids Handling Service in Coal Conversion, Morgantown, West Virginia, 14 Nov. 1977
(Contract W-7405-eng-26)
(CONF-771145-2) Avail: NTIS HC A02/MF A01

To evaluate the valve requirements associated with coal conversion, seven prospective coal conversion design concepts were studied; and flow streams were determined; valve types were assigned and the valves were sized. At present, it appears that the coal conversion processes operate in the range of the present petrochemical industry, except for that portion of the process where the coal is converted to gas and oil. The analysis resulted in the identification of twenty four high temperature valve applications that appeared more stringent than the petrochemical industry needs. ERA

N78-23441# Consolidated Controls Corp., El Segundo, Calif.
COAL GASIFICATION VALVES, PHASE 2 Quarterly Technical Progress Report, Jun. - Aug. 1977
Oct. 1977 30 p
(Contract EX-76-C-01-2355)
(FE-2355-2-Rev-D) Avail: NTIS HC A03/MF A01

Efforts in the design of valves to operate at high temperature in coal gasification plants are detailed. The properties of materials, such as ceramics, which may be satisfactory at these temperatures were determined. The particular properties measured were porosity, permeability, thermal expansion, resistance to mechanical and thermal shock, etc. With these properties known, the problem then was to design the valves to operate within the limits of these properties. Prototype valves are being designed and fabricated for testing. Author (ERA)

N78-23442# Ford Motor Co., Dearborn, Mich. Engineering and Research Staff.
STIRLING ENGINE FEASIBILITY STUDY OF AN 80 TO 100 hp ENGINE OF IMPROVEMENT POTENTIAL FOR EMISSIONS AND FUEL ECONOMY Final Report
D. W. Barton, R. C. Belaire, J. E. Bradley, W. R. Chase, J. R. Corcoran, D. D. Dodge, E. F. Dore, J. E. Fenton, R. K. Fenzan, and L. L. Fobes Nov. 1977 136 p
(Contract EY-76-C-02-2631)
(COO-2631-22) Avail: NTIS HC A07/MF A01

A study was made to evaluate the potential of a Stirling engine for significant improvement in emissions and fuel economy over the present day internal combustion engine and to initiate, on the basis of the experience gained in the Ford/Philips 170 hp Stirling engine development program, the design of an engine in the 80 to 100 hp range suitable for use in a passenger car in the 2,500 to 3,000 lb weight class. The final report given covers two major tasks; testing of a 170 hp Stirling engine powered Torino passenger vehicle; and a design study of an 80 to 100 hp engine in a passenger car in the 2,500 to 3,000 lb weight class based on the 170 hp Torino installation. Despite optimization of the engine to achieve minimum length, the Stirling powered compact car was 89 mm (3.5 inches) longer than its Pinto baseline. Fuel economy of the swashplate engine was adversely affected by attempts to fit it within the Pinto engine compartment. ERA

N78-23443# Babcock and Wilcox Co., Lynchburg, Va. Nuclear Power Generation Div.
ONE-THIRD-SCALE AIR-WATER PUMP PROGRAM: TEST PROGRAM AND PUMP PERFORMANCE
R. W. Winks Jul. 1977 196 p
(EPRI-NP-135) Avail: NTIS HC A09/MF A01

Steady state values of pump head and torque for a 10 inch diameter pump were measured for various mixtures of air and water. The pump is a one-third scale test model of a reactor coolant pump. A number of steady state test conditions were established at the inlet to the pump to determine the degradation of pump single phase head and torque over a range of void fractions from 0 to 90%. The selected test conditions represented the first three quadrants of the pump performance map. Measured values of pump head and torque at known pump airwater flow rates and speeds were converted to dimensionless homologous values to develop a map displaying the transition from fully developed to fully degraded pump head and torque as a function of pump inlet void fraction. ERA

N78-23444# Babcock and Wilcox Co., Lynchburg, Va. Nuclear Power Generation Div.
ONE-THIRD-SCALE AIR-WATER PUMP PROGRAM, ALTERNATE ANALYTICAL PUMP PERFORMANCE DATA
P. A. Treventi, J. J. Cudlin, and C. E. Parks Dec. 1977 38 p refs
(EPRI-NP-385-Vol-1) Avail: NTIS HC A03/MF A01

An alternate version of the analytical model for reactor coolant pump behavior during two phase flow conditions was developed based on the data set obtained from a revised reduction of the steady state data collected during the testing of a one third-scale reactor coolant pump using air-water mixtures. Like the first model, the alternate version relates the single phase homologous characteristics of the pump to the corresponding two phase parameters through multiplier functions of the average void fraction. ERA

N78-23445# Babcock and Wilcox Co., Lynchburg, Va. Nuclear Power Generation Div.
ONE-THIRD-SCALE AIR-WATER PUMP PROGRAM: LOCA AND PUMP OVERSPEED ANALYSES Final Report
R. C. Jones, Jr., C. W. Jones, and C. E. Parks Oct. 1977 55 p refs
(EPRI-NP-474) Avail: NTIS HC A04/MF A01

A pump model developed from air-water test data was incorporated into the CRAFT2 computer code, which is used to solve the evolution of system hydrodynamics and core power generation during the blowdown phase of a hypothetical loss-of-coolant accident. Peak cladding temperature calculations were performed for several break sizes and configurations using this pump model. The results of these calculations were compared to previously calculated results for 205 fuel assembly plants obtained using the same CRAFT model but one that used a pump model developed from the semiscale data. The newly calculated peak cladding temperatures were essentially the same as those obtained previously. ERA

N78-23446# Notre Dame Univ., Ind. Dept. of Metallurgical Engineering and Materials Science.
MICROSTRUCTURAL EFFECTS IN ABRASIVE WEAR Quarterly Progress Report, 16 Jun. - 15 Sep. 1977
Nicholas F. Fiore 1 Oct. 1977 32 p refs
(Contract EF-77-S-02-4246)
(COO-4246-2) Avail: NTIS HC A03/MF A01

Standard procedures were developed for low stress abrasion testing, based on a rubber wheel test system, and for gouging abrasion testing, based on a grinding wheel test system. AISI 1020 and 4340 steels were evaluated as test standards for both systems, and the 1020 was found to provide best reproducibility. Low stress testing was conducted on 2.7C and 3.5C pearlitic, 15Cr-3Mo, 27Cr and Ni-Hard 4 white irons. Microstructural effects are evident in that the 3.5C iron has substantially greater low-stress wear resistance than the 2.7C iron. Moreover, wear resistance across FE3C dendrites is greater than that normal to dendrites. The Ni-Hard 4 irons retained austenite ranging from 5 to 85% volume fraction. Weight loss during wear is at a maximum for 40% retained austenite, indicating that the interrelation between carbide, martensite and retained austenite volume fraction is complex. ERA

N78-23447# Pisa Univ. (Italy). Ist. di Elettrotecnica.
THE MECHANICAL LOAD ON THE TRANSMISSION SHAFT TURBINE-ALTERNATOR [LA SOLLECITAZIONE MECCANICA SULL'ALBERO DI TRASMISSIONE TURBINA-ALTERNATORE]
O. Bruno and G. Zini [1977] 7 p In ITALIAN
(Rept-1610) Avail: NTIS HC A02/MF A01

The problem posed by the torsional couple on the transmission shaft turbine-alternator resulting from large disturbances in the electric power supply network was analyzed. The mechanical system was represented by two concentrated masses, resulting from the turbine and from the alternator inertia, coupled by a torsional spring. Two mathematical models are proposed: a nonlinear one of general validity and a linear one which permits the calculation, with excellent approximation, of the maximum torsional couple. The most critical cases in which the transmission shaft may operate are analyzed. ESA

N78-23448# Pisa Univ. (Italy). Ist. di Elettrotecnica.
ANALYSIS OF THE MECHANICAL OSCILLATIONS IN THE TRANSMISSION SHAFT TURBINE-ALTERNATOR [ANALISI DELLE OSCILLAZIONI MECCANICHE NELL'ALBERO DI TRASMISSIONE TURBINA-ALTERNATORE]
O. Bruno and G. Zini [1977] 5 p refs In ITALIAN
(Rept-1611) Avail: NTIS HC A02/MF A01

An electromechanical power system turbine-alternator was considered, consisting of n concentric rotating masses and of n-1 connecting torsional springs. The center of gravity was defined, and the movement of the various masses was decomposed into a rigid movement coinciding with the center of gravity and into an oscillatory movement around it. The polynomial giving the autovalues of the mechanical system was calculated and some properties characterizing the eigenfrequencies of the system were derived from it. ESA

N78-23449# Eidgenoessisches Flugzeugwerk, Emmen (Switzerland). Research and Testing Dept.
INITIAL DEVELOPMENT OF A VAPOR COMPRESSOR FOR A HEAT PUMP TO BE USED IN SPACECRAFT Final Report
Felix Berner Paris ESA Dec. 1977 56 p refs
(Contract ESTEC-2447/75-AB)
(F+W-FO-1402; ESA-CR(P)-1029) Avail: NTIS HC A04/MF A01

The initial work on a simple vapor compressor for a heat pump for use in spacecraft under zero-g conditions is described. The compressor is of the piston type with automatic valves, i.e., with reed-type suction valves, and disk-type exhaust valves. The design concept differs from current practice in that the refrigerant flow passages are sealed off from all oil-lubricated parts, such as bearings, and that the compressor is separated from its motor. Special features of the pump design are: (1) the refrigerant, which may leak between piston and cylinder wall, is contained by metal bellows and is conducted back to the suction manifold; (2) dry-lubricated piston rings and axial guidance of piston by ball bearing; and (3) special measures to limit the pressure build-up in the cylinder when liquid refrigerant is ingested: an exhaust valve with very large flow cross section, a very low (average) piston speed achieved with the selection of a relatively small stroke, and a friction clutch between the compressor and its motor. Author (ESA)

N78-23450# Royal Aircraft Establishment, Farnborough (England).
A DYNAMIC METHOD OF DETERMINING THE STIFFNESS AND CROSS AXIS STABILITY OF A REPULSION MAGNETIC BEARING
R. N. A. Plimmer Aug. 1977 20 p refs
(RAE-TR-77122; BR60409) Avail: NTIS HC A02/MF A01

The dynamics of a repulsive type magnet bearing is analyzed and a simple pendulum experiment to determine the radial stiffness by measuring the vibration frequency is proposed. The analysis, based on the potential energy of the system, shows the relationship between radial stiffness and the pendulum arm length and also predicts a rotational stability condition, namely that the bearing length to diameter ratio must be greater than the square root of 3 for stability. Author (ESA)

N78-23451# National Gas Turbine Establishment, Farnborough (England).
THE PERFORMANCE OF A 6.5 PRESSURE RATIO CENTRIFUGAL COMPRESSOR HAVING A RADIALLY-VANED IMPELLER
M. G. Jones London Aeron. Res. Council 1977 56 p refs Supersedes NGTE-R-342; ARC-37043
(ARC-CP-1385; NGTE-R-342; ARC-37043) Avail: NTIS HC A04/MF A01; HMSO £2.50; PHI $9.80

The aerodynamic design and experimental performance of a centrifugal compressor designed for a pressure ratio of 6.5 and a specific speed of 68 are described. The compressor consisted of a radially-vaned impeller and a transonic, vaned radial diffuser. At design speed a peak overall total-to-total isentropic efficiency of 0.746 was achieved at the maximum pressure ratio of 5.9, rising to 0.79 at a pressure ratio of 3.5 at 80% speed. A theoretical analysis of the impeller channel flow suggests that high vane-to-vane aerodynamic loading was partly responsible for the shortfall in performance. The impeller was also tested with a vaneless diffuser and a detailed analysis is made of static pressure measurements on the impeller shroud and vaneless and vaned diffuser walls. Several recommendations are made regarding the design and testing of centrifugal compressors. Author (ESA)

N78-23452 National Technical Information Service, Springfield, Va.
ELECTRON BEAM WELDING. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jan. 1978
William E. Reed Mar. 1978 247 p Supersedes NTIS/PS-77/0156; NTIS/PS-76/0136 and NTIS/PS-75/226
(NTIS/PS-78/0184/8; NTIS/PS-77/0156; NTIS/PS-76/0136; NTIS/PS-75/226) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 13H

This updated bibliography contains 242 abstracts of federally-sponsored research reports concerning the development, automation, and applications of electron beam welding. Properties of electron beam welds and weldability of steel, aluminum, refractory metals, heat resistant alloys, and corrosion resistant alloys are included. Thirty-six citations are new entries to the previous edition. GRA

N78-23453 National Technical Information Service, Springfield, Va.
ELECTRON BEAM WELDING, VOLUME 1. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1974 - 1976
William E. Reed Mar. 1978 234 p
(NTIS/PS-78/0185/5) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 13H

Reports from worldwide research are cited covering the process, automation, equipment, and applications of electron beam welding. Properties and weldability of steel, aluminum, titanium, refractory, metals, and heat resistant alloys included in this updated bibliography contain 226 abstracts, none of which are new entries to the previous edition. GRA

N78-23454 National Technical Information Service, Springfield, Va.
ELECTRON BEAM WELDING, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1977 - Feb. 1978
William E. Reed Mar. 1978 100 p Supersedes NTIS/PS-77/9157; NTIS/PS-76/0137
(NTIS/PS-78/0186/3; NTIS/PS-77/0157; NTIS/PS-76/0137) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 13H

This updated bibliography contains 93 abstracts of reports from worldwide research on electron beam welding and the properties and weldability of steel, aluminum, titanium, refractory metals, and heat resistant alloys. Only three of the citations appeared in the previous edition. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N78-23455 Wisconsin Univ., Madison.
ON THE PERFORMANCE OF THE MODIFIED LEAST SQUARES ESTIMATORS IN SOME ACCELERATED LIFE TESTING MODELS USING COMPLETE AND TYPE 2 CENSORED SAMPLES Ph.D. Thesis
Zanzawi Soejoeti 1977 187 p
Avail: Univ. Microfilms Order No. 7802986

A parametric family of life distributions, with a probability density function depending on scale and shape parameters, is considered. The joint asymptotic normality of the least squares estimators (LSE) of the regression coefficients and the residual mean square, under some conditions on the matrix are established. Also considered are the asymptotic normality of the maximum likelihood estimators (MLE) in a location-scale family of distributions for the log-life, where the location parameter has a linear regression structure. Expressions are derived for the asymptotic efficiencies (AE) of the MLSE relative to the MLE for this model. Some applications of the results developed are discussed. Some Monte Carlo studies of the performance of the MLSE and MLE in small samples are presented. Dissert. Abstr.

N78-23456 Wisconsin Univ., Madison.
A STOCHASTIC APPROACH TO PAPER SURFACE CHARACTERIZATION AND PRINTABILITY CRITERIA Ph.D. Thesis
Shiv Gopal Kapoor 1977 314 p
Avail: Univ. Microfilms Order No. 7728257

A quantitative evaluation of paper printability has continually been a main concern to both papermakers and printers, and this thesis, utilizing a new stochastic approach called Dynamic Data System (DDS) analysis, develops certain quantitative indices for determining the printability of various grades of papers. Furthermore, a mathematical model is determined for the paper surface from profile data and the model is used for the physical characterization and analysis of the printing process.
Dissert. Abstr.

N78-23457*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THERMOGRAPHIC MEASUREMENT OF FATIGUE DAMAGE
John D. Whitcomb May 1978 30 p refs
(NASA-TM-78693) Avail: NTIS HC A03/MF A01 CSCL 14D

Heat generated by cyclic loading of fatigue damaged material raised surface temperatures. The temperatures were measured with an infrared camera. The measured temperatures were used as boundary conditions in a finite element heat transfer program, which was developed especially to calculate the extent of the heat generation zone, and thereby to define the fatigue damage zone. The finite element program was verified by comparing calculated heat generation with the actual heat generation for a simple heat transfer problem that has a closed form solution. The program was also checked by analyzing the thermogram of a composite specimen with an external heat source of known dimensions. From thermograms of test specimens, damage zones were calculated for (O sub 8), (45/90/-45/0) sub s and (45/0/-45/0)sub s boron/epoxy fatigue specimens. Calculated damage zones were compared with damage detected by C-scan, X-ray, and SEM examination. The analysis was effective in locating the boundaries of the fatigue damage zones. Author

N78-23458# Florida State Univ., Tallahassee. Dept. of Statistics.
A RELIABILITY GROWTH MODEL INVOLVING DEPENDENT COMPONENTS Interim Report
N. Langberg and F. Proschan Oct. 1977 15 p refs
(Grant AF-AFOSR-2581-74; AF Proj. 2304)
(AD-A051179; FSU-STATISTICS-M437; AFOSR-78-0275TR; TR-77) Avail: NTIS HC A02/MF A01 CSCL 12/1

Earlier papers have shown how to convert competing risk models involving dependent random variables into models involving only independent random variables, while simultaneously preserving the distribution of the minimum and the probabilities of the various failure patterns. The present paper considers a sequence of such conversions occurring at successive points in chronological time in which the independent random variables are becoming stochastically larger. The results obtained demonstrate that the limiting distributions in the sequence of dependent models correctly correspond to the limiting distributions in the sequence of independent models. These results have applications in reliability growth models and in biomedical competing risk models in which the competing risks are increasing with age; in these models dependency is permitted among the random variables. GRA

N78-23459# Princeton Univ., N. J. Dept. of Statistics.
A COMPARATIVE STUDY OF MODELS FOR RELIABILITY GROWTH
Henry Braun and J. Macon Paine (Bell Telephone Labs, Murray Hill, N. J.) Jul. 1977 40 p
(Grant DAAG29-76-G-0298)
(AD-A051537; TR-126-SER-2; ARO-14244.2-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

The deterministic Duane Model as well as several stochastic models for reliability growth are studied. Graphical and quantitative techniques for assessing the performance of these models are introduced and are illustrated on a set of data. A small-scale simulation is carried out in which the effect of two factors (the number of failure modes and the range of failure intensities) are investigated. Some practical conclusions are drawn and the possibility of employing doubly stochastic Poisson processes is discussed. Author (GRA)

N78-23460# IIT Research Inst., Chicago, Ill.
DEVELOPMENT OF SYSTEM/EQUIPMENT RELIABILITY CORPORATE MEMORY Final Report, 29 Jun. 1976 - 30 Jun. 1977
James R. Wingfield Griffiss AFB, N. Y. RADC Jan. 1978 170 p ref
(Contract F30602-76-C-0370; AF Proj. 2338)
(AD-A051503; IITRI-E6370; RADC-TR-77-419) Avail: NTIS HC A08/MF A01 CSCL 05/2

The feasibility of establishing a systems/equipment Reliability Corporate Memory (RCM) is studied. The purpose of an RCM is to continuously accumulate, compile, analyze and report reliability, maintainability and cost data on systems and equipment. Availability of these systems/equipments would ultimately improve with the identification and control of R and M sensitive parameters through all phases of development. Author (GRA)

N78-23461# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
USER'S GUIDE FOR THE RELIABILITY ANALYSIS SYSTEM (RAS)
Dale M. Rasmuson, Neldon H. Marshall, and Gary R. Burdick Sep. 1977 117 p refs
(Contract EY-76-C-07-1570)
(TREE-1168) Avail: NTIS HC A06/MF A01

The Reliability Analysis System (RAS) is an integrated package of computer programs for the quantification of fault trees. In particular, RAS has the capacity of performing phased mission analysis. RAS is based upon the MOCUS, POCUS, KITT-1, SRTPRN, and COMCAN programs. Mission cut set cancellation and four methods of bounding mission unreliability have been incorporated into RAS. A new cut set algorithm, FATRAM, is also included in RAS. RAS is written for the CDC Cyber-76 computer system and utilizes external storage devices. ERA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N78-23462 Cincinnati Univ., Ohio.
AN ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF ELASTO-PLASTIC STRAIN OF A STRIP IN COMBINED BENDING AND TENSION Ph.D. Thesis
Howard Emerson Whisler 1977 75 p
Avail: Univ. Microfilms Order No. 78-03421

This thesis study was motivated by the problem of designing tension roller leveling machines. An analytical model was developed for successive elasto-plastic strains of a strip of metal in combined bending and tension. A procedure was developed to compute the strain of the metal strip for given bending radii and tensions using the analytical model. A laboratory machine was designed, built, and operated to obtain data with which computed results could be compared. Based on the computed and experimental results, it was concluded that the strain of strip under combined bending and tension can be computed for three bends. Dissert. Abstr.

N78-23463 Illinois Univ., Urbana-Champaign.
EFFECT OF BEAM STRENGTH AND STIFFNESS ON DYNAMIC BEHAVIOR OF REINFORCED CONCRETE COUPLED WALLS Ph.D. Thesis
John Michael Lybas 1977 593 p
Avail: Univ. Microfilms Order No. 7804079

A series of one-twelfth scale reinforced concrete coupled walls were subjected to one component of the 1940 Imperial Valley, California earthquake using an earthquake simulator. A similar test structure was subjected to slowly applied cyclic lateral loading, producing yielding in both directions. Variables in the experimental program were strength and stiffness of the connecting beams. A second analytical study was performed, in which the structures were considered to be subjected to the earthquake base motions of the tests using the earthquake simulator. The hysteretically responding test structures were represented by a linearly elastic model, with reduced stiffness, and viscous damping to account for hysteretic energy dissipation. Dissert. Abstr.

N78-23464 Northwestern Univ., Evanston, Ill.
NUMERICAL MODEL STUDIES ON DUCTILE FRACTURE Ph.D. Thesis
Minoru Taya 1977 96 p
Avail: Univ. Microfilms Order No. 7805333

Several numerical methods which can be used to solve large deformation elasto-plastic problems are discussed. Two variational principles are first formulated. Based on these, several finite-element formulations are then presented, and their relative effectiveness is verified by numerical examples. This dissertation also analyzes the mechanism of ductile fracture of an elasto-plastic material by one of the developed finite-element methods. First we solve the necking problem of a bar in plane strain. Then, we study the microscopic behavior of a unit cell consisting of a matrix with a void at the center. The numerical results show that there exists two extreme types of ductile fracture modes: (1) the coalescence of voids, and (2) the formation of an intense shear band. A possible ductile fracture criterion is then proposed, which involves the average plastic work and a plastic localization parameter. Dissert. Abstr.

N78-23465 Michigan Univ., Ann Arbor.
THERMAL STRESSES WITH PHASE CHANGES Ph.D. Thesis
Shigeyasu Amada 1977 79 p
Avail: Univ. Microfilms Order No. 7804635

The study is concerned with elastic and elastoplastic thermal stress analysis with phase changes. An infinite plate with a circular hole, having an uniform temperature and zero stresses initially, is heated to above the melting temperature of the material and subsequently cooled down to the room temperature at its inner boundary. A region near the inner boundary undergoes two kinds of phase changes, crystal structural changes and liquid-solid phase change. The main concern of this work is to clarify stress behaviors of an infinite plate subjected to the effects of phase changes. Dissert. Abstr.

N78-23466 Texas A&M Univ., College Station.
CUMULATIVE DAMAGE UNDER REVERSED TRANSVERSE SHEAR SUPERIMPOSED UPON STATIC TENSION Ph.D. Thesis
Gholam Hossein Nazari 1977 99 p
Avail: Univ. Microfilms Order No. 7806821

Cylindrical specimens of 7075-T6 aluminum alloy were subjected to reversed shear stress and static mean stress to study the effect of mean static tensile stress on cumulative fatigue damage under reversed shear stress. The reversed shear stress amplitude varied in three steps. Test specimens were of double shear model, with minimum diameters of 0.3 plus or minus 0.002 inches. These specimens were tested under different combinations of reversed shear and static tension. Dissert. Abstr.

N78-23467 Akron Univ., Ohio.
EVALUATION OF ELASTIC-PLASTIC STRESSES IN QUENCHED CARBURIZED CYLINDERS BY FINITE ELEMENT METHODS Ph.D. Thesis
Jesse Alan Burnett 1977 263 p
Avail: Univ. Microfilms Order No. 7804922

Experimentally generated data such as the dilatation strains, temperature dependent elastic-plastic properties, thermal profiles from quenching etc., were used as input data for a specialized elastic-plastic finite element program. This program was specifically written for this study and allowed determination of the stress history and showed the development of residual stresses in case hardened 8620 steel cylinders. The stresses were evaluated from the onset through the final stages of oil and water quenching. Special emphasis was given to quantitatively establish the degree of plastic flow, the austenite to body centered tetragonal phase transformation for the case and core, case and core chemistry, and all other factors leading to the final residual stresses. Dissert. Abstr.

N78-23468 Carnegie-Mellon Univ., Pittsburgh, Pa.
ELASTO-PLASTIC FLOW IN CRACKED BODIES USING A NEW FINITE ELEMENT MODEL Ph.D. Thesis
Michael E. Karabin, Jr. 1977 188 p
Avail: Univ. Microfilms Order No. 7804936

Cracked geometries are studied by finite element techniques with the aid of a new special element embedded at the crack tip. The singular stresses and strains associated with the elasto-plastic flow process are represented. The singularity is treated as an unknown. For each step of the incremental process the nodal degrees of freedom and the unknown singularity are found through minimization of an energy-like functional. The singularity and nodal degrees of freedom are determined by means of an iterative process. Dissert. Abstr.

N78-23469 Engineering Sciences Data Unit, London (England).
BUCKLING OF STRUTS. LIPPED AND UNLIPPED Z SECTIONS
Nov. 1977 12 p
(ESDU-77030; ISBN-0-85679-203-9) For information on availability of series, sub-series, and other individual data items, write NTIS, attn: ESDU, Springfield, Va. 22161. HC $242.50

For the first time a complete set of curves which gives the buckling stress of practical, thin, Z-section struts are provided. All buckling modes and their interactions are included and the presentation is arranged so that the detail geometry of the strut can be chosen to improve the resistance of the section to buckling. The presentation automatically yields the buckling wavelength. For the case of local buckling, plasticity corrections are provided. Typical applications include aircraft ribs, and floor and seat supports. ESDU

N78-23470# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
FOUR LECTURES ON FATIGUE CRACK GROWTH
J. Schijve Oct. 1977 89 p refs
(LR-254; ICAF-980) Avail: NTIS HC A05/MF A01

Aspects of the technical meaning of fatigue considerations in practice are indicated. The fatigue life is subdivided into a crack nucleation period and a crack propagation period. The significance of recognizing these periods for practical problems is illustrated by several examples. The similarity approach for correlating fatigue data is introduced. The meaning of the stress intensity factor for fatigue crack growth is discussed. Author

N78-23471*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

INTERPOLATION AND EXTRAPOLATION OF CREEP RUPTURE DATA BY THE MINIMUM COMMITMENT METHOD. PART 1: FOCAL-POINT CONVERGENCE

S. S. Manson (Case Western Reserve Univ.) and C. R. Ensign 1978 101 p refs Proposed for presentation at Symp. on Characterization of Mater. Intended for Serv. at Elevated Temp. at the Pressure Vessels and Piping Conf., Montreal, 26-29 Jun. 1978; cosponsored by ASME and Can. Soc. Mech. Engr. Sponsored in part by Elec. Power Res. Inst. 3 Vol.

(NASA-TM-78881; E-9614) Avail: NTIS HC A06/MF A01 CSCL 20K

A specialized variation of the minimum commitment method is obtained by expressing the relation logt + AP logt + P = G where t is the rupture time, P a function of temperature, and G a function of stress. The term A was considered a structural stability parameter because it was found that the more unstable the material the higher was the negative value of A required to fit the data. The functional forms of P and G were still left to be determined from the station values determined by analysis. The extensions that were made through the development of the above equation are discussed. The discussion provides descriptions of how to implement the method both manually or by computer code. The method is illustrated in detail for Astroloy - a nickel base alloy for which the particular lot available showed embrittling instability involving a phase precipitation. It is also applied to a number of other steels, nickel base alloys, and aluminum alloys. Author

N78-23472*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

INTERPOLATION AND EXTRAPOLATION OF CREEP RUPTURE DATA BY THE MINIMUM COMMITMENT METHOD. PART 2: OBLIQUE TRANSLATION

S. S. Manson (Case Western Reserve Univ.) and C. R. Ensign 1978 29 p refs Proposed for presentation at Symp. on Characterization of Mater. Intended for Serv. at Elevated Temp. at the Pressure Vessels and Piping Conf., Montreal, 26-29 Jun. 1978; cosponsored by ASME and Can. Soc. Mech. Engr. Sponsored in part by Elec. Power Res. Inst. 3 Vol.

(NASA-TM-78882; E-9615) Avail: NTIS HC A03/MF A01 CSCL 20K

A new concept is introduced whereby the creep-rupture isothermals are generated by an oblique translation of the master curve plotted on the conventional coordinates. For most materials a constant translation angle of around 5 deg relative to the horizontal axis is satisfactory. However, for highly unstable materials, such as a heat of Astroloy subject to sigma phase precipitation, an angle as high as 15 deg may be required. For best results the translation angle should depend on temperature, the lower temperatures requiring a lower angle. The method is, in fact, a generalization of other approaches but it allows for the other types of temperature effects than only those displayed by elastic modulus E. Implementation of the method can be accomplished either by manual-graphical means, or completely by computer, the major advantage being the ease of manual analysis. The method is illustrated for the unstable heat of Astroloy. Good results were obtained. Author

N78-23473*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

INTERPOLATION AND EXTRAPOLATION OF CREEP RUPTURE DATA BY THE MINIMUM COMMITMENT METHOD. PART 3: ANALYSIS OF MULTIHEATS

S. S. Manson (Case Western Reserve Univ.) and C. R. Ensign 1978 33 p refs Proposed for presentation at Symp. on Characterization of Mater. Intended for Serv. at Elevated Temp. at the Pressure Vessels and Piping Conf., Montreal, 26-29 Jun. 1978; cosponsored by ASME and Can. Soc. Mech. Engr. Sponsored in part by Elec. Power Res. Inst. 3 Vol.

(NASA-TM-78883; E-9616) Avail: NTIS HC A03/MF A01 CSCL 20K

The Minimum Commitment Method was applied to two sets of data for which multiple heat information was available. For one alloy, a 304 stainless steel studied in Japan, data on nine well characterized heats were used, while for a proprietary low alloy carbon steel studied in the United Kingdom data were available on seven heats - in many cases to very long rupture times. For this preliminary study no instability factors were used. It was discovered that heat-to-heat variations would be accounted for by introducing heat identifiers in the form A + B log sigma where sigma is the stress and the constants A and B depend only on the heat. With these identifiers all the data could be collapsed onto a single master curve, even though there was considerable scatter among heats. Using these identifiers together with the average behavior of all heats made possible the determination of an accurate constitutive equation for each individual heat. Two basic approaches are discussed for applying the results of the analysis. Author

N78-23474# Royal Aircraft Establishment, Farnborough (England).

DESIGN AND TESTING OF AN ACTIVE VIBRATION AND FLUTTER DAMPING SYSTEM FOR EXTERNAL STORES

H. Hoenlinger May 1977 31 p Transl. into ENGLISH of West Ger. Conf. paper Presented at DGLR Symp. CCV Technol., Munich, 17 Sep. 1976

(RAE-Lib-Trans-1919; BR62005; DGLR-76-241) Avail: NTIS HC A03/MF A01

A system for increasing the flutter speed of a wing with external stores is described. An aerodynamic vane mounted on the store is controlled to add aerodynamic damping to the system. A flight experiment is described and preliminary results given. Author

N78-23475# Aeronautical Research Labs., Melbourne (Australia).

TWO SOURCES OF ERROR IN LOAD CELL CIRCUITS

E. S. Moody Jan. 1976 11 p

(ARL/Struc-Note-419; ICAF-927) Avail: NTIS HC A02/MF A01

Sources of small errors in the circuits of a strain gauge load cell were considered. The first is the reduction in cell sensitivity brought about by the introduction of an initial balance network; and the second concerns the change in bridge output volts across a finite detector load as a result of change in bridge source impedance. Procedures to establish load equivalence of amplifier output signals can be arranged to take these sources of error into account. Author

N78-23476# Physics International Co., San Leandro, Calif.

ALUMINUM RING THERMOSTRUCTURAL RESPONSE STUDY Final Report, Mar. - Sep. 1976

V. Buck and J. Shea Nov. 1977 104 p refs

(Contract DNA001-76-C-0246)

(AD-A052026; AD-E300129; DNA-4155F) Avail: NTIS HC A06/MF A01 CSCL 13/13

The response of aluminum rings subjected to sudden radiation heating was experimentally investigated using pulsed electron beams. The DNA OWL II generator, operating at a nominal mean voltage of 1.0 MeV, provided the radiation environment. Transport of the electron beam from the diode to the target was achieved using a longitudinal magnetic field. The aluminum rings were 8 inches in diameter, 2-inches wide, and 0.12 inch thick. The rings were rigidly clamped over a 10 degree segment opposite from the irradiated side. Circumferential strain data were obtained on the inner surface of the rings at 0, + or - 45, 90, 135, and 170 deg with respect to the axis of the electron beam. Transverse strain data were also obtained at 0 deg. Quartz gauge stress measurements were performed on flat aluminum specimens simultaneously with the ring experiments. The response was also observed with fast motion pictures (4000 fames/sec). Data were obtained at fluences that varied between 5 cal/sq cm (elastic response) and 20 cal/sq cm (elastic-plastic response). Author (GRA)

N78-23477# Dundee Univ. (Scotland). Dept. of Mechanical Engineering.

PARAMETRIC AND NONLINEAR MODE INTERACTION BEHAVIOR IN THE DYNAMICS OF STRUCTURES Final Report, Jun. 1974 - Nov. 1977

A. D. Barr and R. P. Ashworth Dec. 1977 90 p refs

(Grant AF-AFOSR-2723-74; AF Proj. 2307)

(AD-A052005; AFOSR-78-0416TR) Avail: NTIS HC A05/MF A01 CSCL 20/11

The report is concerned with the resonant behavior of general

structural systems under single frequency harmonic excitation. In particular it is concerned with the parametric and nonlinear phenomena which arise when there are certain integral relationships between the excitation frequency and some of the natural frequencies of the structure (external resonance), and among the natural frequencies themselves (interval resonance). GRA

N78-23478# Columbia Univ., New York. Dept. of Civil Engineering and Engineering Mechanics.
DYNAMIC ELASTIC-PLASTIC RESPONSE OF A CONTAINMENT VESSEL TO FLUID PRESSURE PULSES Technical Report, 31 Dec. 1976 - 30 Jun. 1977
G. Nikolakopoulou and F. DiMaggio Feb. 1978 63 p refs
(Contract N00014-75-C-0695)
(AD-A052148; TR-52) Avail: NTIS HC A04/MF A01 CSCL 18/9

The dynamic analysis of the wall of a fluid-filled unstiffened nuclear containment vessel, to the fluid pressure exerted on it when the relief valve discharge piping is cleared, is extended into the plastic range using two versions of an elastic-plastic shell theory. Author (GRA)

N78-23479# Michigan State Univ., East Lansing. Div. of Engineering Research.
EXPERIMENTAL STUDIES OF COLDWORKED FASTENER HOLES Final Report, 1 Mar. 1975 - 31 Dec. 1977
William N. Sharpe, Jr. Feb. 1978 22 p refs
(Grant AF-AFOSR-2817-75; AF Proj. 2307)
(AD-A051985; AFOSR-78-0421TR) Avail: NTIS HC A02/MF A01 CSCL 20/11

This report summarizes the accomplishments of this research and catalogs its resulting papers and reports. When an oversized mandrel is pulled through a hole, the material near the hole edge is coldworked. After the mandrel is removed, the elastic restoring forces of material away from the hole generate compressive stresses at the edge. Subsequent tensile loading must overcome the compressive edge stresses, so a considerable improvement in the ultimate or fatigue loading capability of a structure can be achieved. The research was performed in four phases: Phase 1-Measurement of the residual strains around coldworked holes. Phase 2-Measurement of the location of the boundary between the elastic and plastic regions around the hole. Phase 3-A study of fatigue crack initiation and growth from coldworked and noncoldworked holes. Phase 4-A study, similar to Phase 3, of holes that had existing cracks and were then coldworked. Author (GRA)

N78-23480# Pratt and Whitney Aircraft Group, East Hartford, Conn.
BOUNDARY-INTEGRAL EQUATION METHOD FOR ELASTIC FRACTURE MECHANICS ANALYSIS Final Report, 1 Apr. 1974 - 30 Sep. 1977
T. A. Cruse and R. B. Wilson Nov. 1977 64 p refs
(Contract F44620-74-C-0060; AF Proj. 2307)
(AD-A051992; PWA-5585; AFOSR-78-0355TR) Avail: NTIS HC A04/MF A01 CSCL 20/11

A review of recent progress in three-dimensional boundary-integral equation fracture mechanics analysis is presented. New results are discussed concerning the use of special crack tip elements in boundary-integral equation analysis. A formulation is presented for the extension of boundary-integral equation analysis to materials with inhomogeneous material properties and to transient thermoelastic problems. Author (GRA)

N78-23481# Naval Surface Weapons Center, White Oak, Md. Advanced Weapons Dept.
STRESS WAVE PROPAGATION IN BARS DUE TO NORMAL IMPACT ON WATER Ph.D. Thesis Final Report
William T. Messick and John M. Marshall Aug. 1977 404 p refs
(SR0230300)
(AD-A052051; NSWC/WOL/TR-77-128) Avail: NTIS HC A18/MF A01 CSCL 19/4

The stress wave response of solid, right circular, cylindrical bars due to normal impact on an undisturbed water surface was investigated analytically and experimentally. The analytical problem was formulated as a two dimensional axisymmetrical elastic bar impacting on an initially perfectly flat, compressible water half space. Method of characteristics - finite difference solutions were obtained for the Lagrangian system of bar equations and Eulerian water equations, and programmed for computer solution. Strain-gaged magnesium bars were shot with a 3 inch diameter air gun into a chamber which was evacuated to the vapor pressure of water for preserving an undisturbed water surface prior to impact. Shots were made with a bare magnesium nose (unmitigated) and with rigid polyurethane foam noses of densities 5 and 15 pounds per cubic feet. The use of a foam nose greatly reduces the transmitted stress to the bar. GRA

N78-23482# Battelle Columbus Labs., Ohio.
THE DEVELOPMENT OF AN ANALYTICAL PREDICTION TECHNIQUE FOR VARIABLE AMPLITUDE FATIGUE CRACK PROPAGATION Final Report, 1 Jul. 1976 - 30 Jun. 1977
M. F. Kanninen, C. Atkinson, J. C. Bell, W. I. Griffith, and D. W. Schmueser 30 Jun. 1977 114 p
(Contract N62269-76-C-0316)
(AD-A051584; BATT-G-6490; NADC-77255-30) Avail: NTIS HC A06/MF A01 CSCL 20/11

The development of a fatigue crack-growth predictive technique for variable amplitude loading, initiated under previous NADC support, was continued. Attention was focused on a simple version of the general model. This provided a crack growth predictive formula for constant amplitude loading. Comparisons with experimental results and a semiempirical crack-growth law show that the prediction is quite realistic. The work has also indicated how improvements in the general model can be made to cope with more realistic service conditions. The further steps required to develop an efficient model that can cope with both variable amplitude loading and environmental effects are outlined. Author (GRA)

N78-23483# Oakland Univ., Rochester, Mich. School of Engineering.
OPTIMIZATION OF GEOMETRIC DISCONTINUITIES IN STRESS FIELDS
A. J. Durelli, K. Brown, and P. Yee Mar. 1978 38 p refs
(Contract N00014-76-C-0487; Grant NSF ENG-77-07974)
(AD-A051453; Rept-46) Avail: NTIS HC A03/MF A01 CSCL 13/13

The ideal boundary of a discontinuity is defined as that boundary along which there is no stress concentration. Photoelastically an isochromatic coincides with the ideal boundary. This property is used to develop experimentally ideal boundaries for some cases of technological interest. The concept of 'coefficient of efficiency' is introduced to evaluate the degree of optimization. The procedure to idealize boundaries is illustrated for the two cases of the circular tube and of the perforated rectangular plate, with prescribed functional restraints and a particular criterion for failure. An ideal design of the inside boundary of the tube is developed which decreases its maximum stress by 25%, at the time it also decreases its weight by 10%. The efficiency coefficient is increased from 0.59 to 0.95. Tests with a brittle material show an increase in strength of 20%. An ideal design of the boundary of the hole in the plate reduces the maximum stresses by 26% and increases the coefficient of efficiency from 0.54 to 0.90. Author (GRA)

N78-23484# Maryland Univ., College Park. Dept. of Aerospace Engineering.
FINITE DIFFERENCE ENERGY TECHNIQUES FOR ARBITRARY MESHES APPLIED TO LINEAR PLATE PROBLEMS
V. Pavlin and N. Perrone (ONR, Arlington, Va.) Jan. 1978 30 p refs
(Contract N00014-76-C-0872)
(AD-A051200; TR-78-1) Avail: NTIS HC A03/MF A01 CSCL 20/11

A new energy based finite difference analytical technique is introduced. The method incorporates certain energy concepts and the ability to use arbitrary, irregular meshes within the framework of the Finite Difference Method. This formulation reduces any governing partial differential equations to a set of difference equations containing partial derivatives up to and including the second order. Further certain strong similarities with the popular Finite Element Method are shown and the ability to solve problems with irregular boundaries is discussed. To demonstrate the Finite

Difference Energy Method, several plate bending problems are solved. Author (GRA)

N78-23485# Maryland Univ., College Park. Dept. of Aerospace Engineering.

A REFINED QUADRILATERAL FLAT PLATE FINITE ELEMENT BASED ON THE EXTENDED FIELD METHOD

W. W. Schur and B. K. Donaldson Jan. 1978 51 p refs
(Contract N00014-76-C-0872; NR Proj. 064-583)
(AD-A051201; TR-78-2) Avail: NTIS HC A04/MF A01 CSCL 20/11

A new quadrilateral finite element for the problem of bending of a uniform, homogeneous, isotropic, flat plate having an arbitrary number of nodal points and allowing an arbitrary level of refinement is developed from solution functions to the governing differential equation. Interelement continuity to the appropriate level of normal derivatives is provided in least error fashion by the use of spline functions for the edge displacement quantities and minimization by the Galerkin technique. Even for general quadrilateral domains no numerical quadrature is required for developing this finite element since all required integrals are taken over straight boundary edges and can be evaluated explicitly. With this new type of element, an improvement in accuracy is expected to result when large quadrilateral regions are modeled by a single element with an appropriate number of edge nodal points, because the error of this finite element approximation is associated with the boundary region of the elements. The force vector corresponding to the transverse pressure is derived from a series solution to the inhomogeneous differential equation, so that the effect of the forcing function in the element interior can be evaluated to any degree of accuracy desired. Author (GRA)

N78-23486# California Univ., San Diego. Dept. of Applied Mechanics and Engineering Sciences.

ON TWO AND THREE-DIMENSIONAL RESULTS FOR ROTATIONALLY SYMMETRIC DEFORMATIONS OF CIRCULAR CYLINDRICAL SHELLS Interim Report

S. Nair and E. Reissner Nov. 1977 36 p refs
(Contract N00014-75-C-0158)
(AD-A051627) Avail: NTIS HC A03/MF A01 CSCL 20/11

Previous considerations by asymptotic expansion procedures of the relation between elasticity theory results and thin-shell theory results for the case of rotationally symmetric deformations of an edge-loaded semi-infinite circular cylindrical shell are supplemented by an analysis of this problem for a shell possessing a limiting-type orthotropy, such that transverse normal strains vanish identically. It is shown that assuming this kind of orthotropy has the important benefit of allowing the derivation of exact expressions for the edge zone solution contribution, when such exact expressions are not possible for the problem of the shell with more general properties of the material. Author (GRA)

N78-23487# California Univ., San Diego. Dept. of Applied Mechanics and Engineering Sciences.

A NOTE ON FINITE DEFLECTIONS OF CIRCULAR RING PLATES Interim Report

E. Reissner Jan. 1978 13 p
(Contract N00014-75-C-0158)
(AD-A051626) Avail: NTIS HC A02/MF A01 CSCL 20/11

This report solves the problem of the symmetrically deforming edge loaded polar-orthotropic circular ring plate for the case of large deformations of a radially rigid plate, and compare the results with the corresponding solutions in accordance with the small finite deformation equations of von Karman. GRA

N78-23488# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Computer Sciences.

AN ELASTO PLASTIC CONTACT PROBLEM

Claes Johnson 1977 24 p refs
(CTH-77.07-R) Avail: NTIS HC A02/MF A01

The problem of finding the stresses and the displacements in an elasto-plastic body E in frictionless contact with a rigid body pressed against E is studied. The existence of a solution is proven and then finite element methods for finding approximate solutions of the problem are considered. Author (ESA)

N78-23489# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Computer Sciences.

SOME EQUILIBRIUM FINITE ELEMENT METHODS FOR TWO-DIMENSIONAL ELASTICITY PROBLEMS

C. Johnson and B. Mercier 1977 26 p refs
(CTH-77.08-R) Avail: NTIS HC A03/MF A01

Some equilibrium finite element methods for two-dimensional elasticity problems were considered. The stresses and displacements were approximated by using piecewise linear functions. The L2-estimates of order O(h square) for both stresses and displacements were established. Author (ESA)

N78-23490# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.

FATIGUE TESTING OF TRANSVERSELY LOADED ALUMINIUM LUGS

Nils Larsson Oct. 1977 46 p
(FFA-TN-HU-1673) Avail: NTIS HC A03/MF A01

A first sequence of fatigue testing with lugs of forged aluminum AZ 74 is reviewed. The testing comprised lugs of three types and loadings in two directions. Lugs type A2 had its edge surfaces parallel. Type B and C had edge surfaces bevelling at angles 30, resp. 60 deg. The pin holes had 8 mm diameter. Loading directions were phi = 0 and phi = 90 deg to the principal direction of the lug. Loading was applied as alternating tension with phi(min) = 500 N, for lugs type A2 also phi(mean) = 0. The test results showed no marked difference in fatigue strength between the three types of lugs, when loaded at an angle phi = 0. At the angle phi = 90, type A2 had the lowest and type C the highest strength. Scatter was less for phi = 90 than for phi = 0. Observations of fretting and crack initiation are labelled. The investigation is continued with two more lug types (A1 and A3) and three more loading directions (phi = 30, 60, and 110). Author (ESA)

N78-23491# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.

SHEAR FATIGUE TESTS WITH ALUMINIUM LAP JOINTS BONDED WITH SAAB ADHESIVE 9313-2 (BSL 308A)

Nils Larsson Oct. 1977 23 p refs
(FFA-TN-HU-1704) Avail: NTIS HC A02/MF A01

Fatigue tests and static tests with single shear lap joints of 2.5 mm thick plates of SAAB aluminum 3627-48 bonded together with SAAB adhesive 9313-2 (BSL 308A) are presented. The width of the overlap was 6 mm. Fatigue curves were produced for shear stress ratios R = -1, R = -0.5, and R = 0 as well as for tau min = 1.5 kp/sq mm. Including static tests, about 50 specimens were utilized. Achieved mean shear strength was tau ult = 5.8 kp/sq mm. S-N curves and the equivalent Haig diagram have been drawn. Author (ESA)

N78-23492# European Space Agency, Paris (France).

IMPROVEMENT OF MODAL METHODS FOR DYNAMIC RESPONSE PROBLEMS OF LINEAR ELASTIC STRUCTURES

Fritz Kiessling Mar. 1978 48 p refs Transl. into ENGLISH of 'Verbesserung modaler Verfahren fuer Probl. der dyn. Antwort linearer elastischer Systeme', DFVLR, Goettingen, West Ger. Report DLR-FB-77-33, 8 Aug. 1977 Original report in GERMAN previously announced as N78-18474 Original German report available from DFVLR, Cologne DM 21
(ESA-TT-467; DLR-FB-77-33) Avail: NTIS HC A03/MF A01

Dynamic response computations of complex linear elastic systems by modal methods are straightforward. Each deformation pattern is represented by a superposition of a finite number of normal modes of the whole system or of its components. The accuracy of the results depends on mode selection and truncation. The use of global approximations for the neglected normal modes, to get better results, is discussed. The necessary input data can be obtained by vibration tests. Possible improvements are demonstrated by example calculations. Author (ESA)

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

N78-23493 Northern Colorado Univ., Greeley.
A RISK MODEL FOR DRY-LAND WHEAT PRODUCTION IN EASTERN COLORADO Ph.D. Thesis
James Henry Barton 1977 95 p
Avail: Univ. Microfilms Order No. 7805489

The patterns of dry-land, winter wheat failure in eastern Colorado counties between 1946 and 1973 were examined. A combination of factor analysis and multiple linear regression was used to develop models which identified those significant climatic and edaphic variables related to the wheat harvest. Effects of technology were examined by testing for differences in failure per unit of climatic variation over the study period. Subregional differences in climatic and edaphic factors were statistically identified and mapped, and a comprehensive model was developed which integrated the effects of climate, soils, and technology.
Dissert. Abstr.

N78-23494 Arizona Univ., Tucson.
SYNTHESIS OF THE WATER BUDGET ON A SEMIARID WATERSHED Ph.D. Thesis
Severo Rombaoa Saplaco 1977 78 p
Avail: Univ. Microfilms Order No. 7805784

The evaluation was accomplished by identifying and quantifying the primary components of the water budget, rainfall, surface runoff, soil moisture content, and (collectively) other water losses. In addition to the evaluation of the water budget, regression models of surface runoff, soil moisture content, and suspended sediment were developed. Finally, chemical analysis of the runoff water and an evaluation of a water balance simulation model were made.
Dissert. Abstr.

N78-23495 Ohio State Univ., Columbus.
PHOTOGRAMMETRIC REFRACTION Ph.D. Thesis
Jose Bittencourt DeAndrade 1977 127 p
Avail: Univ. Microfilms Order No. 7805802

A mathematical model capable of describing the systematic effects on the photocoordinates due to the actual refraction of the ray of light in its path from the ground up to the camera lens was investigated. The procedure of recovering its parameters in a simultaneous block (or strip) adjustment was studied. It is shown, using different calibration data, that significant improvement in the accuracy of the pass points results when the proposed function to describe photogrammetric refraction was introduced in the mathematical model.
Dissert. Abstr.

N78-23496* + National Aeronautics and Space Administration, Washington, D. C.
EARTH RESOURCES: A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 12, JANUARY 1977
Jan. 1977 123 p
(NASA-SP-7041(12)) Avail: NTIS HC E05 CSCL 05B

This bibliography lists 526 reports, articles, and other documents introduced into the NASA scientific and technical information system between October 1976 and December 1976. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis.
Author

N78-23497*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
TEN-ECOSYSTEM STUDY (TES) SITE 4, SANDOVAL COUNTY, NEW MEXICO Final Report
W. H. Parkhurst, Principal Investigator Feb. 1978 57 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. EREP
(Contract NAS9-15200)
(E78-10110; NASA-CR-151680; LEC-11284) Avail: NTIS HC A04/MF A01 CSCL 02F

The author has identified the following significant results. Mapping accuracies for level 2 classes were about 95% in the overall probability of correct classification. Dense stands of pinyon-juniper could not be separated from other conifers. Level 3 forest species separation was not possible. The use of a contiguous 10% training area is not practical. The ten-ecosystem study technical analysis procedures proved to be a valid method for completing the study.

N78-23498*# Geological Survey, Denver, Colo.
THERMAL SURVEILLANCE OF ACTIVE VOLCANOES USING THE LANDSAT-1 DATA COLLECTION SYSTEM. PREFACE AND PART 1: THE SURTSEY, ICELAND, TEMPERATURE DATA RELAY EXPERIMENT VIA LANDSAT-1 Final Report, 1972 - 1975
Jules D. Friedman, David Frank, Duane M. Preble, and Sveinn Jakobsson, Principal Investigators (Museum of Natural History, Reykjavik, Iceland) Dec. 1975 89 p refs Submitted for publication Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70243-AG)
(E78-10121; NASA-CR-156971) Avail: NTIS HC A05/MF A01 CSCL 08K

The author has identified the following significant results. Combined aerial IR surveys and DCP heat flux estimates at Mt. Baker, Washington, revealed that recurrent snow, ice, and debris avalanches were in part induced by subglacial geothermal emission and led to the prediction that geothermally-induced volcanic events would occur again at Mt. Baker. On March 10, 1975, the prediction was substantiated when significant and sudden increase in subglacial steam emission perforated the crater glacier in Sherman Crater at Mt. Baker. Analysis of sterographic pairs of LANDSAT MSS images led to the discovery of three large ring structures (the largest, 34 km in diameter) that were interpreted as volcanic centers and possible collapsed calderas or volcanotectonic depressions of post Miocene age in Lassen volcanic region.

N78-23499*# Geological Survey, Denver, Colo.
THERMAL SURVEILLANCE OF ACTIVE VOLCANOES USING THE LANDSAT-1 DATA COLLECTION SYSTEM. PART 4: LASSEN VOLCANIC REGION Final Report, 1972 - 1975
Jules D. Friedman and David Frank, Principal Investigators Apr. 1978 83 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70243-AG)
(E78-10123; NASA-CR-156973) Avail: NTIS HC A05/MF A01 CSCL 08K

The author has identified the following significant results. Analysis of LANDSAT 1 MSS images of October 6, 24, and 25, 1972 of the Lassen volcanic region, California, revealed the existence of three large geomorphic rings between Lassen Peak and Lake Almanor. Ring 1, about 16 x 33 km and 490 sq km in area, was centered on the North Branch of the North Fork of the Feather River. Ring 2, 18 x 20.5 km and 300 sq km in area, was concentric to and enclosed by ring 1. Ring 3, 23 x 11 km and 230 sq km in area, was centered on Butt Mountain and cuts ring 1 on the south. All three rings consisted of composite curvilineaments that represent geologic features of two categories: (1) geologically mapped structures and volcanic landforms, and (2) landforms and lines of geomorphic origin that were inferred to represent the surface expression of subsurface structures.

Stream-valley and lake-shoreline continuations of mapped faults, escarpments, and aligned segments of stream valleys were included in the 2d category. The rings overlap a gravity low 5300 sq km in area, and might be the surface expression of volcanotectonic collapse structures that followed eruption of voluminous ash flow tuffs begining in Miocene times.

N78-23500*# Geological Survey, Denver, Colo.
THERMAL SURVEILLANCE OF ACTIVE VOLCANOES USING THE LANDSAT-1 DATA COLLECTION SYSTEM. PART 5: ELECTRONIC THERMAL SENSOR AND DATA COLLECTION PLATFORM TECHNOLOGY Final Report, 1972 - 1975
Duane M. Preble, Jules D. Friedman, and David Frank, Principal Investigators Feb. 1976 64 p refs ERTS
(NASA Order S-70243-AG)
(E78-10124; NASA-CR-156974) Avail: NTIS HC A04/MF A01 CSCL 08K

The author has identified the following significant results. Five LANDSAT data collection platforms were integrated electronically with thermal sensing systems, emplaced and operated in an analog mode at selected thermal significant volcanic and geothermal sites. The DCP's transmitted 3260 messages comprising 26,080 ambient, surface, and near surface temperature records at an accuracy of + or - 1.15 C for 1121 instrument days between November 14, 1972 and April 17, 1974. In harsh, windy, high altitude volcanic environments, the DCP functioned best with a small dipole antenna. Sixteen kg of alkaline batteries provided a viable power supply for the DCP systems, operated at a low duty cycle, for 5 to 8 months.

N78-23501*# NUS Corp., Rockville, Md.
REMOTE SENSING APPLICATIONS TO A PARTIAL AREA MODEL Final Report, Apr. 1970 - Jul. 1977
Edwin T. Engman and John R. Annett, Principal Investigators Jul. 1977 94 p refs ERTS
(Contract NAS5-23399)
(E78-10125; NASA-CR-156741; NUS-3048) Avail: NTIS HC A05/MF A01 CSCL 08B

The author has identified the following significant results. Storm volumes simulated with geometry delineated from LANDSAT and aircraft infrared imagery were compared with calibration volumes simulated with geometry delineated by hand from soils maps. Results show that where land use is indicative of the soils in a watershed, remotely sensed data can provide good results in a partial area model. Contributing areas were not identifiable by any criteria other than land use. Good results can not be expected in areas with uniform land use with this approach.

N78-23502*# California Univ., Santa Barbara. Dept. of Geography.
REMOTE SENSING APPLICATIONS TO HYDROLOGIC MODELING IN THE SOUTHERN SIERRA NEVADA AND PORTIONS OF THE SAN JOAQUIN VALLEY, VOLUME 1 Final Report, 17 Jan. 1977 - 16 Mar. 1978
Jeff Dozier, John E. Estes, David S. Simonett, Principal Investigators, Robert Davis, James Frew, Caryn Gold, Sandra Keith, and Danny Marks May 1978 126 p refs ERTS 2 Vol.
(Grant NsG-5155)
(E78-10126; NASA-CR-156977) Avail: NTIS HC A07/MF A01 CSCL 08H

The author has identified the following significant results. Characteristics of LANDSAT MSS imagery present problems in using satellite radiation measurements to estimate the shortwave albedo of an alpine snow cover. Every 15 minute USGS quadrangle contains over 100,000 pixels which poses a computation problem if each pixel is to be evaluated individually. The sampling interval may be sufficiently great to mask some effects of terrain and vegetation on reflectance. Three frames of LANDSAT imagery are needed for complete coverage of the study area, yet less than one third of the area coverage from each frame covers an area of interest. Because of distortions inherent in the imagery, information regarding spacecraft altitude, attitude, and position must be statistically derived with respect to ground control points in the image whose geodetic locations are known. An inspection of shade points indicates that up to one third of the most heavily snow covered areas may saturate in bands 4 through 6. LANDSAT's 9 day repeat cycle is not optimum for snow cover reflectance modeling because the most pronounced changes in albedo occur most nearly following a new snowfall. Such a snowfall, occurring between overpasses, is inadequately represented by extrapolation from the previous overpasses.

N78-23503*# California Univ., Santa Barbara. Dept. of Geography.
REMOTE SENSING APPLICATIONS TO HYDROLOGIC MODELING IN THE SOUTHERN SIERRA NEVADA AND PORTIONS OF THE SAN JOAQUIN VALLEY, VOLUME 2 Final Report, 17 Jan. 1977 - 16 Mar. 1978
Jeff Dozier, John E. Estes, David S. Simonett, Principal Investigators, Robert Davis, James Frew, Caryn Gold, Sandra Keith, and Danny Marks May 1978 354 p ERTS 2 Vol.
(Grant NsG-5155)
(E78-10127; NASA-CR-156978) Avail: NTIS HC A16/MF A01 CSCL 08H

There are no author-identified significant results in this report.

N78-23504*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
INSTRUMENT TECHNOLOGY FOR REMOTE-SURFACE EXPLORATION, PROSPECTING AND ASSAYING, PART 2
Roy G. Brereton 28 Oct. 1977 89 p refs
(NASA-CR-156997; JPL-710-7-Pt-A) Avail: NTIS HC A05/MF A01 CSCL 14B

The capability to specify new instrument/mechanism technology needs, for effective remote surface exploration, prospecting and assaying (EPA), requires first, an understanding of the functions or major elements of such a task, and second an understanding of the scientific instruments and support mechanisms that may be involved. An analog or task model was developed from which the various functions, operational procedures, scientific instruments, and support mechanisms for an automated mission could be derived. The task model led to the definition of nine major functions or categories of discrete operational elements that may have to be accomplished on a mission of this type. Each major function may stand alone as an element of an EPA mission, but more probably a major function will require the support of other functions, so they are interrelated. Author

N78-23505*# IBM Federal Systems Div., Gaithersburg, Md.
THEMATIC MAPPER DESIGN PARAMETER INVESTIGATION Final Report, Jun. 1976 - Jan. 1978
C. P. Colby, Jr. and S. G. Wheeler Jan. 1978 147 p refs
(Contract NAS5-23585)
(NASA-CR-156756; FSD-780001) Avail: NTIS HC A07/MF A01 CSCL 08B

This study simulated the multispectral data sets to be expected from three different Thematic Mapper configurations, and the ground processing of these data sets by three different resampling techniques. The simulated data sets were then evaluated by processing them for multispectral classification, and the Thematic Mapper configuration, and resampling technique which provided the best classification accuracy were identified. Author

N78-23506*# Delaware Univ., Newark. College of Marine Studies.
DETERMINATION OF SPECTRAL SIGNATURES OF SUBSTANCES IN NATURAL WATERS Final Report
V. Klemas, W. Philpot, and G. Davis 1 Mar. 1978 100 p refs
(Grant NsG-1149)
(NASA-CR-156998) Avail: NTIS HC A05/MF A01 CSCL 08H

Optical remote sensing of water pollution offers the possibility of fast, large scale coverage at a relatively low cost. The possibility of using the spectral characteristics of the upwelling light from water for the purpose of ocean water quality monitoring was explained. The work was broken into several broad tasks as follows: (1) definition of a remotely measured spectral signature of water, (2) collection of field data and testing of the signature analysis, and (3) the possibility of using LANDSAT data for the identification of substances in water. An attempt to extract spectral signatures of acid waste and sediment was successful. Author

N78-23507*# Ohio State Univ. Research Foundation, Columbus.
THE PREDICTION AND MAPPING OF GEOIDAL UNDULATIONS FROM GEOS-3 ALTIMETRY
William Kearsley Wallops Island, Va. NASA. Wallops Flight Center Apr. 1978 52 p refs
(Contract NAS6-2484)
(NASA-CR-141439) Avail: NTIS HC A04/MF A01 CSCL 08B

From the adjusted altimeter data an approximation to the geoid height in ocean areas is obtained. Methods are developed to produce geoid maps in these areas. Geoid heights are obtained for grid points in the region to be mapped, and two of the parameters critical to the production of an accurate map are investigated. These are the spacing of the grid, which must be related to the half-wavelength of the altimeter signal whose amplitude is the desired accuracy of the contour; and the method adopted to predict the grid values. Least squares collocation was used to find geoid undulations on a 1 deg grid in the mapping area. Twenty maps, with their associated precisions, were produced and are included. These maps cover the Indian Ocean, Southwestern and Northeastern portions of the Pacific Ocean, and Southwest Atlantic and the U.S. Calibration Area. Author

N78-23508*# Cornell Univ., Ithaca, N. Y. School of Civil and Environmental Engineering.
CORNELL UNIVERSITY REMOTE SENSING PROGRAM Semiannual Status Report, 1 Jun. - 30 Nov. 1977
Ta Liang, Arthur J. McNair, and Warren R. Philipson Dec. 1977 118 p refs
(Grant NGL-33-010-171)
(NASA-CR-156993; SASR-11) Avail: NTIS HC A06/MF A01 CSCL 05B

Aircraft and satellite remote sensing technology were applied in the following areas: (1) evaluation of proposed fly ash disposal sites; (2) development of priorities for drainage improvements; (3) state park analysis for rehabilitation and development; (4) watershed study for water quality planning; and (5) assistance project-landfill site selection. Results are briefly summarized. Other projects conducted include: (1) assessment of vineyard-related problems; (2) LANDSAT analysis for pheasant range management; (3) photo-historic evaluation of Revolutionary War sites; and (4) thermal analysis of building insulation. The objectives, expected benefits and actions, and status of these projects are described. J.M.S.

N78-23509*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
REMOTE SENSING AND THE EARTH
Craig A. Brosius (School Board of Brevard County, Fla.), Janette C. Gervin, and James M. Ragusa Dec. 1977 497 p refs Orignial contains color illustrations
(NASA-TM-79444) Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue Rockledge, Florida 32955 at $9.74 per copy CSCL 14E

A text book on remote sensing, as part of the earth resources Skylab programs, is presented. The fundamentals of remote sensing and its application to agriculture, land use, geology, water and marine resources, and environmental monitoring are summarized. For individual titles, see N78-23510 through N78-23531.

N78-23510*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
THE BASICS OF REMOTE SENSING; FORWARD
In its Remote Sensing and the Earth Dec. 1977 p 1-9 (For availability see N78-23509 14-43)
Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 14E

Significant early developments of remote sensing are traced, as well as important contributions of the space program. Author

N78-23511*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
APPLICATIONS TO EARTH RESOURCES
In its Remote Sensing and the Earth Dec. 1977 p 10-17 (For availability see N78-23509 14-43)
Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 05B

Remote sensing technology applications to such diverse areas as agriculture, range and forestry; land use; mineral resources; water resources; marine resources; and the environment are discussed. Author

N78-23512*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
THE NATURE OF LIGHT
In its Remote Sensing and the Earth Dec. 1977 p 18-25 (For availability see N78-23509 14-43)
Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 20F

Basic information about the sun, what light is, and the atmospheric effects on light transmission are presented. Author

N78-23513*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
REMOTE SENSORS
In its Remote Sensing and the Earth Dec. 1977 p 26-41 (For availability see N78-23509 14-43)
Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 14E

A variety of photographic and nonphotographic sensors are briefly described which were used for remote sensing purposes. Author

N78-23514*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
REMOTE SENSING PLATFORMS
In its Remote Sensing and the Earth Dec. 1977 p 42-59 (For availability see N78-23509 14-43)
Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 14B

A multitude of remote sensing platforms are examined, including surface observations, balloons, various aircraft, spacecraft, and satellites. Author

N78-23515*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
THE ANALYSIS OF REMOTELY SENSED DATA
In its Remote Sensing and the Earth Dec. 1977 p 60-72 (For availability see N78-23509 14-43)
Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 05B

Variables involved in data analysis and equipment used to process information are discussed. Standard photointerpretation keys for railroad trains and trees are included. J.A.M.

N78-23516*# EROS Data Center, Sioux Falls, S. Dak.
USEFULNESS OF LANDSAT DATA FOR MONITORING PLANT DEVELOPMENT AND RANGE CONDITIONS IN CALIFORNIA'S ANNUAL GRASSLAND
David M. Carneggie, Stephen D. DeGloria (Calif. Univ., Berkeley), and Robert N. Colwell (Calif. Univ., Berkeley) *In* NASA. John F. Kennedy Space Center Remote Sensing and the Earth Dec. 1977 p 77-101 refs (For availability see N78-23509 14-43)
Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 02C

A network of sampling sites throughout the annual grassland region was established to correlate plant growth in stages and forage production to climatic and other environmental factors. Plant growth and range conditions were further related to

geographic location and seasonal variations. A sequence of LANDSAT data was obtained covering critical periods in the growth cycle. Data were analyzed by both photointerpretation and computer aided techniques. Image characteristics and spectral reflectance data were then related to forage production, range condition, range site, and changing growth conditions. Author

N78-23517*# Kansas Univ., Lawrence. Space Technology Center.
UTILIZATION OF LANDSAT IMAGERY FOR MAPPING VEGETATION ON THE MILLIONTH SCALE
Donald L. Williams and Jerry C. Coiner *In* NASA. John F. Kennedy Space Center Remote Sensing and the Earth Dec. 1977 p 102-116 refs Presented at the NASA Earth Resources Surv. Symp. Vol. 1A: Agr. and Environ., Houston, Tex., Jun. 1975 (For availability see N78-23509 14-43)
(Grant NGL-17-004-024)
Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 08F

To determine if the information content of the imagery is sufficient to permit mapping according to the Unesco classification, a series of test sites were examined. These sites include examples from the humid tropics, arid, and semi-arid subtropics and temperature zones. In every case, the feasibility of this application of LANDSAT imagery was verified. The agricultural significance of several sites is discussed to indicate how the vegetation maps may be interpreted for agricultural evaluation. Author

N78-23518*# Geological Survey, Washington, D. C.
CHANGE IN LAND USE IN THE PHOENIX (1:250,000) QUANDRANGLE, ARIZONA BETWEEN 1970 AND 1973: ERTS AS AN AID IN A NATIONWIDE PROGRAM FOR MAPPING GENERAL LAND USE
John L. Place *In* NASA. John F. Kennedy Space Center Remote Sensing and the Earth Dec. 1977 p 117-146 refs Presented at the 3d Earth Resource Technol. Satellite-1 Symp. Vol. 1: Tech. Presentation Sect. A, Washington, D. C., Dec. 1973 (For availability see N78-23509 14-43)
Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 08B

Satellite imagery was used to revise existing land use maps outdated by new residential developments, croplands, and reservoir fill up during a period of dynamic growth in Phoenix, Arizona. Author

N78-23519*# Michigan State Univ., East Lansing.
IMPROVED RESOURCE USE DECISIONS AND ACTIONS THROUGH REMOTE SENSING
R. Hill-Rowley, M. Boylan, W. Enslin, and R. Vlasin *In* NASA. John F. Kennedy Space Center Remote Sensing and the Earth Dec. 1977 p 147-171 Presented at the NASA Earth Resources Surv. Symp. Vol. 1C: Land Use and Marine Resources, Houston, Tex., Jun. 1975 (For availability see N78-23509 14-43)
Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 08F

Remote sensing was applied to the varied needs of government agencies and private organizations for the purpose of assisting decision makers that were responsible for actions concerning resource users. Seven case situations are presented. Author

N78-23520*# Itek Corp., Alexandria, Va. Data Analysis Center.
PHOTOARCHAEOLOGY. RECONNAISSANCE TESTS USING COLOR, AS WELL AS OTHER FILMS, INDICATE THAT EXPLORATION STUDIES MAY BE REDUCED FROM MONTHS TO HOURS
Carl H. Strandberg *In* NASA. John F. Kennedy Space Center Remote Sensing and the Earth Dec. 1977 p 172-180 (For availability see N78-23509 14-43)
Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 05B

Various types of films were used to detect pre-Columbian archaeological sites in South Dakota. Natural color and color IR films (scale 1/10,000) provided the best interpretation medium. Author

N78-23521*# Geological Survey, Washington, D. C.
APPLICATION OF COMPUTER PROCESSED MULTISPECTRAL DATA TO THE DISCRIMINATION OF LAND COLLAPSE (SINKHOLE) PRONE AREAS IN FLORIDA
A. E. Coker, R. Marshall (Mich. Univ., Ann Arbor), and N. S. Thomson (Mich. Univ., Ann Arbor) *In* NASA John F. Kennedy Space Center Remote Sensing and the Earth Dec. 1977 p 181-193 refs Presented at the 6th Intern. Symp. on Remote Sensing of Environ., Oct. 1969 Sponsored in cooperation with Army and AF (For availability see N78-23509 14-43)
Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 08G

Data were collected near Bartow, Florida, for the purpose of studying land collapse phenomena using remote sensing techniques. Data obtained using the multispectral scanner system consisted of various combinations of 18 spectral bands ranging from 0.4-14.0 microns and several types of photography. The multispectral data were processed on a special-purpose analog computer in order to detect moisture-stressed vegetation and to enhance terrain surface temperatures. The processed results were printed on film to show the patterns of distribution of the proposed hydrogeologic indicators. Author

N78-23522*# General Electric Co., Philadelphia, Pa. Space Div.
LANDSAT DATA: A NEW PERSPECTIVE FOR GEOLOGY. A REVIEW OF THE UTILIZATION OF LANDSAT IMAGERY FOR GEOLOGICAL INTERPRETATION
Ralph N. Baker *In* NASA. John F. Kennedy Space Center Remote Sensing and the Earth Dec. 1977 p 194-204 refs (For availability see N78-23509 14-43)
Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 08G

Areas in which LANDSAT satellite imagery were found most useful include regional interpretations of geological structure, updating verifying of geologic maps, mineral and petroleum exploration, and the monitoring of natural hazards such as large-scale erosion and seismicity. Investigations in these areas of application demonstrated the wide variety of uses presently undertaken or envisioned for the future. Author

N78-23523*# California Earth Science Corp., Santa Monica.
ACTIVE AND INACTIVE FAULTS IN SOUTHERN CALIFORNIA VIEWED FROM SKYLAB
P. M. Merifield and D. L. Lamar *In* NASA. John F. Kennedy Space Center Remote Sensing and the Earth Dec. 1977 p 205-225 refs Presented at the NASA Earth Resources Surv. Symp. Vol. 1B: Geol. and Inform., Houston, Tex., Jun. 1975 (For availability see N78-23509 14-43)
Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 08G

A number of prominent linears in basement terrane of the Peninsular Ranges appeared on Skylab images. In most cases, they were represented by straight or gently curved valleys; however, detailed field investigations have shown that several of these linears mark previously unmapped faults which form two distinct fault sets; one set trends northeast, the other west-northwest. No indications of recent movement were present on these faults which were truncated by seismically active, northwest trending fault zones such as the Elsinore and San Jacinto. Right-lateral separation is demonstrable on the northeast trending set. Author

N78-23524*# Geological Survey, Washington, D. C.
OPTICAL DATA PROCESSING AND PROJECTED APPLICA-

TIONS OF THE ERTS-1 IMAGERY COVERING THE 1973 MISSISSIPPI RIVER VALLEY FLOODS

Morris Deutsch (EROS Program) and Fred Ruggles *In* NASA. John F. Kennedy Space Center Remote Sensing and the Earth Dec. 1977 p 226-244 refs Prepared in cooperation with NASA. Goddard Space Flight Center (For availability see N78-23509 14-43)

(Contract DI-14-08-0001-13185)

Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 08H

Flooding was detected along the Mississippi River and some of its tributaries by the multispectral scanner (MSS) on the ERTS-1 on at least three orbits during the spring of 1973. The ERTS data provided the first opportunity for mapping the regional extent of flooding. Special optical data processing techniques were used to produce a variety of multispectral color composites enhancing flood-plain details. One of these, a 2-color composite of near infrared bands 6 and 7, was enlarged and registered to 1:250,000-scale topographic maps and used as the basis for preparation of flood image maps. Two specifically filtered 3-color composites of MSS bands 5,6, and 7 and 4, 5, and 7 were prepared. Author

N78-23525*# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

APPLICATIONS OF ERTS-1 IMAGERY TO TERRESTRIAL AND MARINE ENVIRONMENTAL ANALYSES IN ALASKA

D. M. Anderson, H. L. McKim, W. K. Crowder, R. K. Haugen, L. W. Gatto, and T. L. Marlar *In* NASA. John F. Kennedy Space Center Remote Sensing and the Earth Dec. 1977 p 245-272 refs Presented at the 3d Earth Resources Technol. Satellite-1 Symp. Vol. 1: Tech. Presentations, Sect. B, Washington, D. C., Dec. 1973 (For availability see N78-23509 14-43)

Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 08B

A method is considered for identifying and monitoring estuare in surface water, circulation patterns, and changes at different Alaskan sites. Author

N78-23526*# Geological Survey, Washington, D. C.

WATER-MANAGEMENT MODELS IN FLORIDA FROM LANDSAT-1 DATA

A. L. Higer, E. H. Cordes, A. E. Coker, and R. H. Rogers (Bendix Aerospace Systems Div.) *In* NASA. John F. Kennedy Space Center Remote Sensing and the Earth Dec. 1977 p 273-304 refs Presented at the NASA Earth Resources Surv. Symp. Vol. 1D: Water, Houston, Tex., Jun. 1975 (For availability see N78-23509 14-43)

Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 05A

ERTS-1 is described as a near real time, data relay system for south Florida water quantity and quality monitoring. An ecological model of the Shark River Slough in Everglades National Park is also presented. Author

N78-23527*# Virginia Univ., Charlottesville.

HIGH-ALTITUDE AERIAL PHOTOGRAPHS AID IN INVESTIGATIONS

Robert Dolan and Linwood Vincent *In* NASA. John F. Kennedy Space Center Remote Sensing and the Earth Dec. 1977 p 305-314 refs Sponsored in cooperation with NASA. Wallops Station and USGS (For availability see N78-23509 14-43)

Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 08C

Results of crescentic features study of sandy coasts, using high altitude aerial photography are presented. Author

N78-23528*# Delaware Univ., Newark.

MONITORING COASTAL WATER PROPERTIES AND CURRENT CIRCULATION WITH ERTS-1

V. Klemas, M. Otley, C. Wethe, and R. H. Rogers (Bendix Aerospace Systems Div.) *In* NASA. John F. Kennedy Space Center Remote Sensing and the Earth Dec. 1977 p 315-340 refs Presented at the 3d Earth Reosurces Technol Satellite-1 Symp. Vol. 1: Tech. Presentation, Sect. B, Washington, D. C., Dec. 1973 (For availability see N78-23509 14-43)

Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 08C

Imagery and digital tapes from nine successful ERTS-1 passes over Delaware Bay during different portions of the tidal cycle were analyzed with special emphasis on turbidity, current circulation, waste disposal plumes, and convergent boundaries between different water masses. ERTS-1 image radiance correlated well with Secchi depth and suspended sediment concentration. Circulation patterns observed by ERTS-1 during different parts of the tidal cycle, agreed well with predicted and measured currents throughout Delaware Bay. Author

N78-23529*# Earth Satellite Corp., Washington, D. C.

A FEASIBILITY DEMONSTRATION OF AERIAL PHOTOGRAPHIC SUPPORT FOR MARINE ARCHAEOLOGICAL SURVEYS

A. D. Marmelstein *In* NASA. John F. Kennedy Space Center Remote Sensing and the Earth Dec. 1977 p 341-350 (For availability see N78-23509 14-43)

Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 14E

The use of recutting remote sensing was demonstrated for location of shipwrecks in the Florida Keys, using selected films and filters for improved water penetration. Author

N78-23530*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

THE MAPPING OF MARSH VEGETATION USING AIRCRAFT MULTISPECTRAL SCANNER DATA

M. Kristine Butera *In* NASA. John F. Kennedy Space Center Remote Sensing and the Earth Dec. 1977 p 351-371 refs Presented at the Earth Resources Surv. Symp. Vol. 1A: Agr. and Environ., Houston, Tex., Jun. 1975 (For availability see N78-23509 14-43)

Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 CSCL 08B

Aircraft multispectral scanner data were applied to the identification and mapping of Louisiana marsh vegetation species for salinity ozone determination. Author

N78-23531*# Earth Satellite Corp., Washington, D. C.

SOLID WASTE AND REMOTE SENSING. PRELIMINARY STUDIES SUGGEST THAT SMALL-SCALE AERIAL REMOTE-SENSING RECORDS AND, IN PARTICULAR, AERIAL PHOTOGRAPHS CAN CONTRIBUTE TO REGIONAL SOLID-WASTE MANAGEMENT AND PLANNING

Donald Garofalo and Frank J. Nobber *In* NASA. John F. Kennedy Space Center Remote Sensing and the Earth Dec. 1977 p 372-393 refs Presented at the Ann. Conv. of the Am. Soc. of Photogrammetry, Washington, D. C., Mar. 1973 (For availability see N78-23509 14-43)

Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 13B

Preliminary results of a study exploring the use of aerial remote sensing techniques for solid waste management and planning purposes were considered. Author

N78-23532*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

KOREAN COASTAL WATER DEPTH/SEDIMENT AND LAND COVER MAPPING (1:25,000) BY COMPUTER ANALYSIS OF LANDSAT IMAGERY

K. Y. Park (Colorado State Univ., Fort Collins) and Lee D. Miller May 1978 23 p refs Presented at 7th Ann. Remote Sensing

of Earth Resources Conf., Tullahoma, Tenn., 27-28 Mar. 1978 Submitted for publication
(NASA-TM-79546) Avail: NTIS HC A02/MF A01 CSCL 08B

Computer analysis was applied to single date LANDSAT MSS imagery of a sample coastal area near Seoul, Korea equivalent to a 1:50,000 topographic map. Supervised image processing yielded a test classification map from this sample image containing 12 classes: 5 water depth/sediment classes, 2 shoreline/tidal classes, and 5 coastal land cover classes at a scale of 1:25,000 and with a training set accuracy of 76%. Unsupervised image classification was applied to a subportion of the site analyzed and produced classification maps comparable in results in a spatial sense. The results of this test indicated that it is feasible to produce such quantitative maps for detailed study of dynamic coastal processes given a LANDSAT image data base at sufficiently frequent time intervals. Author

N78-23533*# Alaska Univ., Fairbanks. Geophysical Institute.
APPLICATIONS OF REMOTE SENSING DATA IN ALASKA: A COOPERATIVE PROGRAM OF THE UNIVERSITY OF ALASKA WITH USER ORGANIZATIONS, INCLUDING LOCAL, STATE AND FEDERAL GOVERNMENT AGENCIES Annual Report, 1 Jul. 1975 - 30 Jun. 1976
J. M. Miller 30 Jun. 1976 182 p Original contains color illustrations
(Grant NGL-02-001-092)
(NASA-CR-156996) Avail: NTIS HC A09/MF A01 CSCL 05B

The development of the coastal-zone-related issues is generating an increasing need for information which is greater in quantity of natural resource data, greater in quality of detail of data, and more frequent in collection of data owing to the need to monitor certain aspects of programs. The array, detail, and frequency of information acquisition required to develop natural resources and to implement and maintain the resulting programs demand improved techniques of data gathering, processing, and interpretation which is conducive to the use of remote-sensing techniques. As Alaska, both in the state and federal domain, gears up to meet the energy-related issues facing the nation there will be a growing role for efforts which adapt state-of-the-art tools to solving existing problems. Author

N78-23534*# Florida Inst. of Tech., Melbourne. Center for Coastal Zone Research.
LAND USE AND LAND COVER MAPPING: CITY OF PALM BAY, FLORIDA Final Report
Diane D. Barile and Robert Pierce Nov. 1977 58 p Sponsored by NASA. Kennedy Space Center Original contains color illustrations
(NASA-CR-154625) Avail: NTIS HC A04/MF A01 CSCL 08B

Two different computer systems were compared for use in making land use and land cover maps. The Honeywell 635 with the LANDSAT signature development program (LSDP) produced a map depicting general patterns, but themes were difficult to classify as specific land use. Urban areas were unclassified. The General Electric Image 100 produced a map depicting eight land cover categories classifying 68 percent of the total area. Ground truth, LSDP, and Image 100 maps were all made to the same scale for comparison. LSDP agreed with the ground truth 60 percent and 64 percent within the two test areas compared and Image 100 was in agreement 70 percent and 80 percent. Author

N78-23535*# California State Univ., Los Angeles. Dept. of Mechanical Engineering.
DIFFERENTIAL SCANNING CALORIMETRY OF COAL
Philip I. Gold 10 Apr. 1978 56 p refs
(Grant NsG-7263)
(NASA-CR-156995) Avail: NTIS HC A04/MF A01 CSCL 08G

Differential scanning calorimetry studies performed during the first year of this project demonstrated the occurrence of exothermic reactions associated with the production of volatile matter in or near the plastic region. The temperature and magnitude of the exothermic peak were observed to be strongly affected by the heating rate, sample mass and, to a lesser extent, by sample particle size. Thermal properties also were found to be influenced by oxidation of the coal sample due to weathering effects. Author

N78-23536# Electrotechnical Lab., Tokyo (Japan).
REMOTE SENSING TECHNOLOGY
Yasuo Komamiya, Kazuo Kurokawa, Kenjiro Sakurai, Eizo Teranishi, Yoshimichi Aiyama, Shoei Kataoka, Hiroyuki Fujisada, Munekazu Takano, Hiroshi Shiomi, Kiyoshi Takahisa et al May 1977 277 p refs In JAPANESE; ENGLISH summary
(Rept-192) Avail: NTIS HC A13/MF A01

The current and future prospects of remote sensing technology are surveyed. This report describes remote sensing technology as it relates to the following topics: pollution; land surface and oceans, fundamental technology supporting remote sensing; fundamental properties of electromagnetic radiation and atmospheric effects on remote sensing; passive image sensors; active sensors, microwave sensors, laser radar; acoustic emission and radiant rays; satellite remote sensors and positioning of various platforms; information processing, data processing, data acquisition; and modelling techniques for understanding the cause-and-effect between behavior and environment. Author

N78-23537*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APPLICATION OF REMOTE SENSING TO THE CHESAPEAKE BAY REGION. VOLUME 1: EXECUTIVE SUMMARY
W. T. Chen, G. W. Freas, Jr., G. D. Hickman (Maryland Univ., College Park), D. A. Pemberton (Maryland Univ., College Park), T. D. Wilkerson (Maryland Univ., College Park), I. Adler (Maryland Univ., College Park), and V. J. Laurie (EPA, Washington, D. C.) 1978 47 p Conf. held at Berkeley Springs, W. Va., 12-15 Apr. 1977; sponsored by NASA, EPA, and Maryland Univ., College Park
(NASA-CP-6; G-7719) Avail: NTIS HC A03/MF A01 CSCL 08C

The proceedings are presented of a conference, jointly sponsored by the National Aeronautics and Space Administration, the U.S. Environmental Protection Agency, and the University of Maryland. The purpose of the Conference was to assemble representatives of federal and state government agencies engaged in research on the condition and evolution of the Chesapeake Bay to compose a status report, to present current activities and future plans, and to recommend a long-range future course of policies and programs. Author

N78-23538*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DIELECTRIC CONSTANTS OF SOILS AT MICROWAVE FREQUENCIES-2
J. Wang, T. Schmugge, and D. Williams May 1978 34 p refs
(NASA-TP-1238; G-7802-13) Avail: NTIS HC A03/MF A01 CSCL 20N

The dielectric constants of several soil samples were measured at frequencies of 5 and 19 GHz using the infinite transmission line method. The results of these measurements are presented and discussed with respect to soil types and texture structures. A comparison is made with other measurements at 1.4 GHz. At all three frequencies, the dependence of dielectric constant on soil moisture can be approximated by two straight lines. At low moisture, the slope is less than at high moisture level. The intersection of the two lines is believed to be a function of soil texture. Author

N78-23539# Kewanee Oil Co., Tulsa, Okla.
NORTH STANLEY POLYMER DEMONSTRATION PROJECT First Annual Report
Jarl P. Johnson, J. W. Cunningham, and B. M. DuBois 26 Jul. 1976 169 p refs
(Contract EY-76-C-02-0029)
(COO-0029-1) Avail: NTIS HC A08/MF A01

The efficiency and economics of recovering tertiary oil from a highly heterogeneous reservoir by injecting a polymer slug of tapered concentrations to improve the sweep efficiency of the reservoir were demonstrated. All injection wells were equipped with plastic coated tubing, and packers were set approximately 100 ft above the Burbank sand to prevent the possibility of

subsequent casing leaks thieving off injected polymer. Producing wells were worked over to insure maximum producing capability. The necessary surface facility changes were made to allow the injection of fresh water only and to provide for the disposal of 35,000 BPD of produced water. Polymer storage and blending facilities were constructed in such a manner as to allow control of the mixing process with a minimum of supervision and manpower. A one well mini-injection test was conducted which included a fresh water preflush period, injection of 5,000 lb of Pusher 700 at 1,000 ppM followed by 1,000 lb of Pusher 1,000 at 100 ppM, and a fresh water afterflush period.The mini test established that there would be no significant well bore problems associated with the injection of the polymer. ERA

N78-23540# International Institute for Applied Systems Analysis, Laxenburg (Austria).
ON MEASURES OF NATURAL RESOURCE SCARCITY
Anthony C. Fisher Aug. 1977 33 p refs
(IIASA-RR-17-19) Avail: NTIS HC A03/MF A01

The properties of a number of suggested economic measures (price, cost, and rent) of natural resource scarcity and their behavior as a resource depleted over time are studied. The effect on the current value of each measure of a change in the current estimate of the resource stock is also examined. ESA

N78-23541# Swedish Meteorological and Hydrological Inst., Norkoeping.
SEA ICE-75. GROUND TRUTH REPORT
Ingemar Udin Stockholm Winter Navigation Research Board 1976 77 p refs
(Rept-16-2) Avail: NTIS HC A05/MF A01

A remote sensing project over sea ice in the Bay of Bothnia was carried out during March 1975. Several sensors - microwave, visual and infrared, were tested. Following background information of ice conditions and weather general ice parameters are presented. Satellite information and air photos are analyzed. At the same time as the remote sensing experiment an extensive ground truth program was carried out. Various ice parameters within three different ground truth areas, one inside the other, were studied. These small scale ice observations and measurements and the ground truth program in general are discussed. ESA

N78-23542# Swedish Meteorological and Hydrological Inst., Norkoeping.
SEA ICE-75. ICE DETECTION BY SLAR
R. H. J. Morra and G. P. deLoor Stockholm Winter Navigation Research Board 1976 33 p refs
(Rept-16-3) Avail: NTIS HC A03/MF A01

A sea ice remote sensing experiment was carried out in the Bay of Bothnia during March 1975 using, among other sensors, a real aperture X-band side-looking airborne radar (SLAR). The properties, possibilities, and limitations of SLAR are discussed in detail and an analysis is made of SLAR imagery in comparison with aerial photography. ESA

N78-23543# Swedish Meteorological and Hydrological Inst., Norkoeping.
SEA ICE-75. ANALYSIS OF SLAR DATA
Surendra Parashar Winter Navigation Research Board 1976 56 p refs Partly sponsored by Swed. Board for Space Activities
(Rept-16-4) Avail: NTIS HC A04/MF A01

Results obtained from an analysis of SLAR data collected during a sea ice remote sensing experiment in the Bay of Bothnia during March 1975 are presented. The data gathered included SLAR images of sea ice obtained by utilizing EMI X-band real-aperture radar. The formation of sea ice and its relevant characteristics and the nature of radar returns from sea ice are included for background. A brief historical note on the use of radar for mapping ice is also given. ESA

N78-23544# Winter Navigation Research Board, Stockholm (Sweden).
SEA ICE-75. FLAR, ODAR, SHIP'S RADAR
Ture Hagman (Res. Inst. of Natl. Defence), Jerry Nilsson (Res. Inst. of Natl. Defence), and Yngve Nilsson 1976 35 p refs
(Rept-16-5) Avail: NTIS HC A03/MF A01

Results from a field test on sea ice mapping by radar carried out in the Gulf of Bothnia, March 1975, are presented. Three different types of radar were used: forward looking airborne search radar (FLAR), omnidirectional helicopterborne search radar (ODAR), and shipborne radars of the icebreaker Tor. It is shown that conventional radars can map the large scale ice structure of extensive areas in sufficient detail to assist navigation and ice forecasting. The radars of an icebreaker give short range navigational information on the ice situation with high resolution in real time. Different ways of recording radar information are discussed and some recommendations on further measurements of radar signatures of sea ice are given. Author (ESA)

N78-23545# Research Inst. of National Defence, Stockholm (Sweden).
SEA ICE-75. IR-SCANNER RESULTS
Erik Fagerlund and Gunnar Lundholm Winter Navigation Research Board 1976 22 p refs
(Rept-16-6) Avail: NTIS HC A02/MF A01

During a field experiment over an ice covered area of the Gulf of Bothnia in March 1975, several different types of remote sensing equipment were tested, including infrared thermography performed with the airborne single line scanner TEKLA in the 8 to 14 microm region. The thermal recordings were concentrated to a 5 X 5 square km test area, which was described in great detail by ground truth measurements and photography. During 14 runs at 300 to 2000 m altitude, the thermal radiation from the sea surface was recorded on photographic film and magnetic tape. The film recordings give a general survey of the apparent temperature variations within various parts of the mapped area. By processing the tape recorded information, a more detailed analysis of some interesting objects was accomplished. The results are compared with the available ground truth and aerial photographs. Author (ESA)

N78-23546# Winter Navigation Research Board, Stockholm (Sweden).
SEA ICE-75. RADAR ALTIMETER RESULTS
Sune Axelsson (Saab-Scania AB, Linkoeping) 1976 30 p refs
(Rept-16-7) Avail: NTIS HC A03/MF A01

The results obtained at a field experiment with radar altimetry above sea-ice, carried out in the Gulf of Bothnia, March 1975, are presented. The results indicate that the envelope detected noise of the altimetry output signal can be used for measurements on ice ridges and other large-scale surface roughnesses. The spectral characteristics of the signal also give some information about the surface roughness. The AGC-signal, which is a measure of the reflectivity of the ground surface, may be used to distinguish ice from water as well as snow-covered ice from non-covered ice. As the weather was mild during the whole test period further measurements should be carried out during a period of cold weather. Some modifications of the altimetry equipment are also recommended. Author (ESA)

N78-23547# Swedish Meteorological and Hydrological Inst., Norkoeping.
SEA ICE-75. DYNAMICAL REPORT
Ingemar Udin and Anders Omstedt Stockholm Winter Navigation Research Board 1976 66 p refs
(Rept-16-8) Avail: NTIS HC A04/MF A01

Field measurements on sea ice were carried out in the Bay of Bothnia during March 10-20, 1975. The forces and parameters in the equation of motion for sea ice have been studied on the mesoscale. Winds and currents were measured to calculate the wind and water stress, the ice mass distribution was studied, the tilting of the sea surface computed, temperatures at different ice types measured. From the data obtained and with classical boundary layer theory the forces in the equation of motion have been calculated and their balance studied. The results support the assumption made in a numerical ice forecasting model under development at the Swedish Meteorological and Hydrological Institute and the data obtained will be used for further development and improvements. Author (ESA)

N78-23548# Winter Navigation Research Board, Stockholm (Sweden).
SEA ICE-75 Summary Report

Aake Blomquist (Natl. Defence Res. Inst.), Claes Pilo (Swed. Space Corp.), and Thomas Thompson (Swed. Meteorol. and Hydrol. Inst., Norkoeping) 1976 33 p refs
(Rept-16-9) Avail: NTIS HC A03/MF A01

The results of a sea ice remote sensing experiment carried out in the Bay of Bothnia during March 1975 are reported. The experimental program is outlined and the sensors used - including SLAR, FLAR, microwave and IR sensors - are described. The various ice parameters studied such as thickness, roughness, concentration, and dynamics are also discussed. ESA

N78-23549# International Field Year for the Great Lakes Project Office, Rockville, Md.
INTERNATIONAL FIELD YEAR FOR THE GREAT LAKES BULLETIN Final Task Status Report
NOAA Nov. 1977 124 p refs
(PB-277523/7; IFYGL-BULL-21; NOAA-77123007) Avail: NTIS HC A06/MF A01 CSCL 08H

A joint Canadian-United States list of publications related to IFYGL has been included in each issue since IFYGL Bulletin no. 13. This issue contains as complete a listing as possible of publicatons to be obtained from the IFYGL participants. This issue contains three articles on the results of U.S. IFYGL task work as well as the final task status reports. GRA

N78-23550# Arkansas Univ., Fayetteville. Water Resources Research Center.
LANDSAT LINEAR TREND ANALYSIS: A TOOL FOR GROUNDWATER EXPLORATION IN NORTHERN ARKANSAS Project Completion Report, May 1975 - 30 Jun. 1977
Harold C. MacDonald, Kenneth F. Steele, and Elizabeth Gaines Jun. 1977 118 p refs
(Contract DI-14-34-0001-6004; OWRT Proj. A-034-ARK(1))
(PB-277121/0; PUB-49; W78-03752) Avail: NTIS HC A06/MF A01 CSCL 08H

In northern Arkansas, knowledge of deep aquifers is fairly limited. The development of these deeper aquifers to their fullest potential as reliable water sources depends upon the delineation of high yield areas, a process that may be facilitated by linear trend analysis. Satellite and photolineament maps of the 13 counties were prepared by use of LANDSAT images and agricultural stabilization and conservation service photo indexes. The lineaments and fracture traces on aerial photographs and LANDSAT images are natural linear features such as aligned stream segments, soil tonal and vegetal alignments, and topographic sags. GRA

N78-23551# Arizona Univ., Tucson. Office of Arid Lands Studies.
THE IMPACT OF GROUNDWATER DEVELOPMENT IN ARID LANDS: A LITERATURE REVIEW AND ANNOTATED BIBLIOGRAPHY
Susan Jo Keith 1977 153 p
(Contract DI-14-31-0001-5254)
(PB-276908/1; OWRT-W-197(5254)(2);
ARID-LANDS-RESOURCE-IP-10; W78-03757) Avail: NTIS HC A08/MF A01 CSCL 13B

The importance of anticipating the physical and socioeconomic effects of groundwater development in arid lands is discussed in two case studies. One focuses on the impact of groundwater development on the Papago Indians in Arizona; the second, through a discussion of groundwater development in Pakistan, demonstrates the role groundwater development can play in the economic development process in developing arid countries. GRA

N78-23552 Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
DIGITAL DATA ACQUISITION SYSTEM IN GEOPHYSICAL SURVEY AIRCRAFT VH-BNG
D. N. Downie 1977 72 p refs
(BMR-185; BMR-MF8; ISBN-0-642-03115; Cat-77-6502-7; R77/198) Avail: Issuing Activity

The system records information from one magnetic channel, four gamma-ray spectrometer channels, and two Doppler navigation channels, in addition to altitude and fiducial numbers. Sampling rate is one second, except for magnetic data, which are sampled every 0.2 seconds. The integrated system is built around a Hewlett-Packard 2114B general-purpose computer, interfaced to a 16 channel digital input multiplexer and magnetic tape recorder. A visible and permanent analogue record of the input data is maintained by chart recorders, to enable the operator to monitor data quality and to assist later in interpretation of the data. The chart drive motors can be run at five fixed speeds or coupled to the Doppler signal so that chart speed is proportional to ground speed. The Doppler signals are also coupled to a display unit which assists the pilot to follow the planned flight path. The system is extremely reliable, and error-free flights are common. Author

N78-24041# Joint Publications Research Service, Arlington, Va.
VISUAL OBSERVATION OF THE NATURAL ENVIRONMENT FROM AN ORBITAL STATION
L. V. Denisov *In its* Transl. on USSR Sci. and Technol. (JPRS-71181) 25 May 1978 p 69-75 Transl. into ENGLISH from Priroda (Moscow), no. 12, 1977 p 56-61 (For availability see N78-24033 14-99)
Copyright. Avail: Issuing Activity

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N78-23553 Utah State Univ., Logan.
A THERMAL ENERGY STORAGE TANK MODEL FOR SOLAR HEATING Ph.D. Thesis
Robert Arthur Pate 1977 115 p
Avail: Univ. Microfilms Order No. 77-30657

The results of a combined theoretical and experimental study of the kinetics of a hot liquid energy storage tank are presented. A physical model was developed which accurately describes the thermal stratification behavior in a storage tank. The governing differential equations were developed for the physical model. A numerical solution to the system of equations is presented. Some existing models were examined and the predicted results of each are discussed. The concepts developed can be used to predict the thermal stratification behavior in a storage tank under most conceivable operating conditions. These conditions include flow configurations at the top and the bottom of the tank which both have inversionary tendencies. Dissert. Abstr.

N78-23554 Oregon State Univ., Corvallis.
HEAT TRANSFER EFFECTS IN FORCED GEOHEAT RECOVERY SYSTEMS Ph.D. Thesis
Jonathan Mackey Hanson 1978 226 p
Avail: Univ. Microfilms Order No. 7805355

Forced geoheat recovery using naturally occurring fluid conductors, viz., fault zones, basaltic dikes, and open formation contacts, is considered in terms of the system physical-economic feasibility. The heat transfer surface area required for an economically viable forced recovery system for direct contact heating applications is estimated based on various geologic and economic parameters. The heat transfer surface area reflects the required dimensions of the subsurface system and therefore serves as an indicator of the feasibility of the system. The results indicate that, under current economic conditions and regional geothermal gradients of 50 C/km or more, the minimum heat transfer surface area per injection/production borehole pair required for an economically viable direct-contact heating system with a 10 to 20 year system lifetime is less than 1 sq km. Dissert. Abstr.

N78-23555*# Aerospace Corp., El Segundo, Calif. Advanced Orbital Systems Div.

HIGH EFFICIENCY SOLAR PHOTOVOLTAIC POWER MODULE CONCEPT Final Report
I. Bekey Mar. 1978 151 p refs
(Contract NASw-3078)
(NASA-CR-157002; ATR-78(7666)-1) Avail: NTIS HC A08/MF A01 CSCL 10A

The investigation of a preliminary concept for high efficiency solar power generation in space is presented. The concept was a synergistic combination of spectral splitting, tailored bandgap cells, high concentration ratios, and cool cell areas. Author

N78-23556*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF COMPUTER CODES FOR CALCULATING DYNAMIC LOADS IN WIND TURBINES
David A. Spera 1977 39 p refs Presented at the 3d Bien. Conf. and Workshop on Wind Energy Conversion Systems, Washington, D. C., 19-21 Sep. 1977
(Contract E(49-26)-1028)
(NASA-TM-73773; DOE/NASA/1028-78/16; E-9577) Avail: NTIS HC A03/MF A01 CSCL 10B

Seven computer codes for analyzing performance and loads in large, horizontal axis wind turbines were used to calculate blade bending moment loads for two operational conditions of the 100 kW Mod-0 wind turbine. Results were compared with test data on the basis of cyclic loads, peak loads, and harmonic contents. Four of the seven codes include rotor-tower interaction and three were limited to rotor analysis. With a few exceptions, all calculated loads were within 25 percent of nominal test data. Author

N78-23557*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE POTENTIAL OF COMBINED CYCLES INTEGRATED WITH LOW-Btu GASIFIERS FOR FUTURE ELECTRIC UTILITY APPLICATIONS
Joseph J. Nainiger and Raymond K. Burns [1977] 42 p refs Presented at the 69th Ann. Meeting of the Am. Inst. of Chem. Engr., Chicago, 28 Nov. - 2 Dec. 1976
(NASA-TM-73775; E-9567) Avail: NTIS HC A03/MF A01 CSCL 10A

A comparison and an assessment of 10 advanced utility power systems on a consistent basis and to a common level of detail were analyzed. Substantial emphasis was given to a combined cycle systems integrated with low-Btu gasifiers. Performance and cost results from that study were presented for these combined cycle systems, together with a comparative evaluation. The effect of the gasifier type and performance and the interface between the gasifier and the power system were discussed. Author

N78-23558*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
WAKE CHARACTERISTICS OF A TOWER FOR THE DOE-NASA MOD-1 WIND TURBINE
Joseph M. Savino, Lee H. Wagner, and Mary Nash Apr. 1978 76 p refs
(Contract E(49-26)-1028)
(NASA-TM-78853; E-9575; DOE/NASA/1028-78/17) Avail: NTIS HC A05/MF A01 CSCL 10A

A 1/40th scale model of a tower concept designed for a MOD-1 wind power turbine was tested in a low speed wind tunnel. Wake wind speed profiles were measured, and from these were determined local values of wake minimum velocity ratio, average velocity ratio, and width over a range of tower elevations and wind approach angles. Comparison with results from two other all tubular models (MOD-0 and eight leg designs) tested earlier in the same tunnel indicated that wake width and flow blockage at the rotor plane of rotation were slightly larger for the MOD-1 tower than for the other two models. The differences in wake characteristics were attributed to differences in tower geometry and member dimensions. Author

N78-23559*# Kaman Aerospace Corp., Bloomfield, Conn.
DESIGN STUDY OF WIND TURBINES, 50 kW TO 3000 kW FOR ELECTRIC UTILITY APPLICATIONS: EXECUTIVE SUMMARY Final Report
Jul. 1977 95 p
(Contracts NAS3-19404; E(49-26)-1010)
(NASA-CR-134936; R-1382; DOE/NASA/9404-7611) Avail: NTIS HC A05/MF A01 CSCL 10A

Preliminary designs of low power (50 to 500 kW) and high power (500 to 3000 kW) wind generator systems (WGS) for electric utility applications were developed. These designs provide the bases for detail design, fabrication, and experimental demonstration testing of these units at selected utility sites. Several feasible WGS configurations were evaluated, and the concept offering the lowest energy cost potential and minimum technical risk for utility applications was selected. The selected concept was optimized utilizing a parametric computer program prepared for this purpose. The utility requirements evaluation task examined the economic, operational and institutional factors affecting the WGS in a utility environment, and provided additional guidance for the preliminary design effort. Results of the conceptual design task indicated that a rotor operating at constant speed, driving an AC generator through a gear transmission is the most cost effective WGS configuration. Author

N78-23560*# Kaman Aerospace Corp., Bloomfield, Conn.
DESIGN STUDY OF WIND TURBINES 50 kW TO 3000 kW FOR ELECTRIC UTILITY APPLICATIONS: ANALYSIS AND DESIGN Final Report
Feb. 1976 567 p refs
(Contracts NAS3-10094; E(49-26)-1010)
(NASA-CR-134937; R-1382; DOE/NASA/9404-76/2) Avail: NTIS HC A24/MF A01 CSCL 10A

In the conceptual design task, several feasible wind generator systems (WGS) configurations were evaluated, and the concept offering the lowest energy cost potential and minimum technical risk for utility applications was selected. In the optimization task, the selected concept was optimized utilizing a parametric computer program prepared for this purpose. In the preliminary design task, the optimized selected concept was designed and analyzed in detail. The utility requirements evaluation task examined the economic, operational, and institutional factors affecting the WGS in a utility environment, and provided additional guidance for the preliminary design effort. Results of the conceptual design task indicated that a rotor operating at constant speed, driving an AC generator through a gear transmission is the most cost effective WGS configuration. The optimization task results led to the selection of a 500 kW rating for the low power WGS and a 1500 kW rating for the high power WGS. Author

N78-23561*# Lamar Univ., Beaumont, Tex. Chemical Engineering Dept.
PROCESS FEASIBILITY STUDY IN SUPPORT OF SILICON MATERIAL TASK 1 Quarterly Technical Progress Report
C. S. Fang, Keith C. Hansen, Joseph W. Miller, Jr., and Carl L. Yaws Mar. 1978 81 p refs
(Contract JPL-954343)
(NASA-CR-157030; ERDA/JPL-954343-78/1; QTPR-1) Avail: NTIS HC A05/MF A01 CSCL 10A

Initial results for gas thermal conductivity of silicon tetrafluoride and trichlorosilane are reported in respective temperature ranges of 25 to 400 C and 50 to 400 C. For chemical engineering analyses, the preliminary process design for the original silane process of Union Carbide was completed for Cases A and B, Regular and Minimum Process Storage. Included are raw material usage, utility requirements, major process equipment lists, and production labor requirements. Because of the large differences in surge tankage between major unit operations the fixed capital investment varied from $19,094,000 to $11,138,000 for Cases A and B, respectively. For the silane process the original flowsheet was revised for a more optimum arrangement of major equipment, raw materials and operating conditions. The initial issue of the revised flowsheet (Case C) for the silane process indicated favorable cost benefits over the original scheme. Author

N78-23562*# Texas Instruments, Inc., Dallas.
AUTOMATED ARRAY ASSEMBLY TASK, PHASE 1 Final Report
Bernard G. Carbajal Oct. 1977 213 p refs Prepared for DOE
(Contract JPL-954405)
(NASA-CR-156985; ERDA/JPL-954405-77/7; TI-03-77-44) Avail: NTIS HC A10/MF A01 CSCL 10A

State-of-the-art technologies applicable to silicon solar cell and solar cell module fabrication were assessed. The assessment consisted of a technical feasibility evaluation and a cost projection for high volume production of solar cell modules. Design equations based on minimum power loss were used as a tool in the evaluation of metallization technologies. A solar cell process sensitivity study using models, computer calculations, and experimental data was used to identify process step variation and cell output variation correlations. Author

N78-23563*# Westinghouse Electric Corp., Pittsburgh, Pa. Research and Development Center.
LOW COST SILICON SOLAR ARRAY PROJECT LARGE AREA SILICON SHEET TASK: SILICON WEB PROCESS DEVELOPMENT Quarterly Report
C. S. Duncan, R. G. Seidensticker, J. P. McHugh, P. D. Blais, and J. R. Davis, Jr. 31 Dec. 1977 54 p refs Prepared for JPL, Pasadena, Calif.
(Contracts NAS7-100; JPL-954654)
(NASA-CR-156984; ERDA/JPL-954654-77/3; QR-3) Avail: NTIS HC A04/MF A01 CSCL 10A

Growth configurations were developed which produced crystals having low residual stress levels. The properties of a 106 mm diameter round crucible were evaluated and it was found that this design had greatly enhanced temperature fluctuations arising from convection in the melt. Thermal modeling efforts were directed to developing finite element models of the 106 mm round crucible and an elongated susceptor/crucible configuration. Also, the thermal model for the heat loss modes from the dendritic web was examined for guidance in reducing the thermal stress in the web. An economic analysis was prepared to evaluate the silicon web process in relation to price goals. Author

N78-23564*# Spectrolab, Inc., Sylmar, Calif.
ANALYSIS OF EFFECTS OF IMPURITIES INTENTIONALLY INCORPORATED INTO SILICON Final Report, 1 Feb. - 1 Dec. 1977
Frank Uno 15 Dec. 1977 26 p Prepared for DOE
(Contract JPL-954694)
(NASA-CR-156981; ERDA/JPL-954694-78/1) Avail: NTIS HC A03/MF A01 CSCL 10A

A methodology was developed and implemented to allow silicon samples containing intentionally incorporated impurities to be fabricated into finished solar cells under carefully controlled conditions. The electrical and spectral properties were then measured for each group processed. Author

N78-23565*# ARCO Solar, Inc., Chatsworth, Calif.
TERRESTRIAL SOLAR CELL MODULE AUTOMATED ARRAY ASSEMBLY, TASK 4 Final Report
Jan. 1978 27 p Prepared for JPL Sponsored in part by DOE
(NASA-CR-156982; ERDA/JPL-954761-78/1; ASI-1277-1) Avail: NTIS HC A03/MF A01 CSCL 10A

A cost effective design and manufacturing process which would produce solar cell modules capable of meeting qualification test criteria was developed. Emphasis was placed on the development of an aluminum paste back contact process. Author

N78-23566# Comptroller General of the United States, Washington, D.C.
AN EVALUATION OF THE NATIONAL ENERGY PLAN Report to the Congress
25 Jul. 1977 185 p refs
(EMD-77-48) Avail: NTIS MF A01; GAO HC $1.00

An analysis of the National Energy Plan was made by the General Accounting Office. Recommendations were made for increasing energy conservation if satisfactory progress is not made in achieving the energy goals. Additional recommendations were made to strengthen the plan. Specific suggestions include: adopting a set of national energy goals and designing a program to meet these goals, establishing a set of milestones upon which to judge progress in meeting these goals and, establishing a set of standby initiatives. Many of these alternatives will have to be mandatory if the milestones indicate that satisfactory progress is not made. P.R.A.

N78-23567*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMBINED SOLAR COLLECTOR AND ENERGY STORAGE SYSTEM Patent Application
Ronald N. Jensen, inventor (to NASA) Filed 28 Apr. 1978 12 p
(NASA-Case-LAR-12205-1; US-Patent-Appl-SN-900843) Avail: NTIS HC A02/MF A01 CSCL 10A

A solar heating system comprised of a combined solar energy collector, fluid chiller and energy storage system was developed. A movable interior insulated panel in a storage tank is positionable flush against the storage tank wall to insulate the tank for energy storage. The movable interior insulated panel is alternately positionable to form a solar collector or fluid chiller through which the fluid flows by natural circulation. NASA

N78-23568# Oregon State Univ., Corvallis. Engineering Experiment Station.
AN EVALUATION OF USES FOR LOW TO INTERMEDIATE TEMPERATURE GEOTHERMAL FLUIDS IN THE KLAMATH BASIN, OREGON
Gordon M. Reistad, Wilson E. Schmisseur, J. Ralph Shay, and James B. Fitch Mar. 1978 137 p refs Sponsored by the Pacific Northwest Regional Commission
(Bull-55) Avail: NTIS HC A07/MF A01

The potential is considered of using geothermal energy in the low to intermediate temperature range (30 to 150 C) for industrial and agricultural processes in the Klamath Basin in Oregon. Resource-based industries that could utilize hot water in an integrated or cascaded system were emphasized. Integrated systems for geothermal fluid use are those in which the fluid is shared jointly between several processes and cascaded from higher to successively lower temperature uses. A wide variety of processes were screened. From this initial screening, nine were identified for more extensive engineering and economic analysis: greenhouse tree seedling production, greenhouse tomato production, controlled environment swine production, barley malting, methane generation from swine wastes, lumber drying, potato flake dehydration, fish protein concentration, and catfish production in heated ponds. Author

N78-23569# Committee on Agriculture, Nutrition, and Forestry (U. S. Senate).
ENERGY POLICY AND STRATEGY FOR RURAL DEVELOPMENT, PART 1
Washington GPO 1977 237 p refs Hearings before Subcomm. on Rural Development of the Comm. on Agriculture, Nutrition, and Forestry, 95th Congr., 1st Sess., 13-14 Jul. 1977
(GPO-94-275) Avail: Subcomm. on Rural Development

Addressed are the energy problems and strategies developed to combat the Nation's energy problems as they affect rural development. Witnesses from various organizations, primarily the U.S. Department of Agriculture and Energy Research and Development Administration, offer testimonies and answer questions concerning the energy problems and strategies. G.Y.

N78-23570# Committee on Agriculture, Nutrition, and Forestry (U. S. Senate).
ENERGY POLICY AND STRATEGY FOR RURAL DEVELOPMENT, PART 2
Washington GPO 1977 56 p refs Hearings before Subcomm. on Rural Development of the Comm. on Agriculture, Nutrition, and Forestry, 95th Congr., 1st Sess., 13 Sep. 1977
(GPO-97-394) Avail: Subcomm. on Rural Development
For abstract, see N78-23569.

N78-23571*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
NUCLEAR WASTE DISPOSAL IN SPACE
R. E. Burns, W. E. Causey, W. E. Galloway, and R. W. Nelson May 1978 118 p refs
(NASA-TP-1225; M-250) Avail: NTIS HC A06/MF A01 CSCL 18G

Work on nuclear waste disposal in space conducted by the George C. Marshall Space Flight Center, National Aeronautics and Space Administration, and contractors are reported. From the aggregate studies, it is concluded that space disposal of nuclear waste is technically feasible. Author

N78-23572# Mathematical Sciences Northwest, Inc., Bellevue, Wash.
ENERGY DEMAND FORECASTING MODEL, TECHNICAL APPENDIX. COMPUTER PROGRAM USERS GUIDE AND OPERATIVE MANUAL, DATA BASE USERS GUIDE, AND PACIFIC NORTHWEST ENERGY DATA BASE Final Report
W. Michael McHugh, J. Michael Storie, James W. Lockett, Stephen G. Scott, and Edward A. Holt 1977 370 p Sponsored by Northwest Energy Policy Project, Portland, Oreg.
(PB-276921/4; NEPP-2) Avail: NTIS HC A16/MF A01 CSCL 10A

Operating instructions and system documentation for a computerized energy demand forecasting model are presented. The model has the capability to forecast energy demand for four fuel types for the three Northwest states, in five-year steps, from 1980 through the year 2000. The forecasts were further broken down into the residential, commercial, industrial, transportation, and other sectors. The model written in FORTRAN for the CDC 6500 computer, is econometric, correlating over 800 time series. GRA

N78-23573# Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
GaAs CONCENTRATOR PHOTOVOLTAIC POWER SYSTEM FEASIBILITY INVESTIGATION Final Report, 15 Jun. 1976 - 30 Sep. 1977
S. Kamath, R. C. Knechtli, S. Schwartz, and G. Wolff Dec. 1977 99 p
(Contract F33615-76-C-2142)
(AD-A051851; SCG-70392P; AFAPL-TR-77-80) Avail: NTIS HC A05/MF A01 CSCL 10/2

A number of GaAs Solar Cells for high sunlight intensity operation were fabricated and experimentally evaluated. I-V characteristics were determined for 1, 5, and 9 solar constants. Temperature coefficients of OCV, SCC, and Pmax were determined for one sun GaAs cells by measuring cell electrical performance at 50 C steps from -190 C to +250 C. Results of 1 Mev electron irradiation to 1 x 10 to the 16th power, Mev equivalent electrons/sq cm and welded interconnect investigations are presented. Author (GRA)

N78-23574# Mallory (P. R.) and Co., Inc., Burlington, Mass. Lab. for Physical Science.
SEALED PRIMARY LITHIUM-INORGANIC ELECTROLYTE CELL Quarterly Report, 1 Oct. - 31 Dec. 1977
A. N. Dey Mar. 1978 38 p ref
(Contract DAAB07-74-C-0109)
(AD-A051801; ECOM-74-0109-14; QR-14) Avail: NTIS HC A03/MF A01 CSCL 10/3

The objective of this program is to develop a D cell which is storable and operable in the temperature range of -40 to 160 F and is capable of delivering in excess of 150 WHr/lb at the thirty hour rate and peak power density of 50 watts/lb and a capacity degradation of less than 10% after one month of storage at 160 F. We showed that all the above objectives can be met by the hermetic Li/SOCl2 D cells developed by us. In fact, the low rate D cells developed by us on a separate program delivered capacities of 18 A.Hr at a constant voltage of 3.5 volt corresponding to an energy density of 290 WHr/lb and 20 WHr/cu in. at low drains (0.01-0.03A). High rate cells routinely delivered 12 A.Hr at 1.0A drain corresponding to energy density of 156 WHr/lb and 11 WHr/cu in. GRA

N78-23575# Naval Weapons Center, China Lake, Calif.
DIFFERENTIAL SCANNING CALORIMETRY STUDIES OF SOME ELECTROLYTE SYSTEMS PERTINENT TO THERMAL BATTERIES Research Report, Nov. 1976 - Aug. 1977
Dwight A. Fine and Aaron N. Fletcher Feb. 1978 28 p refs
(ZF61112001; ZF54595003)
(AD-A052139; NWC-TP-6014) Avail: NTIS HC A03/MF A01 CSCL 10/3

The thermal behavior of some electrolyte systems which are potentially useful in thermal batteries has been investigated by differential scanning calorimetry. The reactivity of calcium metal in molten nitrates and thiocyanates has been studied. The nitrate systems are the most promising. It has been found that a passivating layer of calcium oxide is formed on the metal in molten nitrates; this layer can be broken down in a controllable manner by the addition of Lux-Flood acids or alkali halides to the nitrates. Author (GRA)

N78-23576# Oak Ridge National Lab., Tenn. Engineering Technology Div.
DESALTING SEA WATER AND BRACKISH WATERS: A COST UPDATE
S. A. Reed and J. V. Wilson 20 Oct. 1977 31 p refs
(Contract W-7405-eng-26)
(ORNL-TM-5926) Avail: NTIS HC A03/MF A01

Cost estimates are given for desalting seawater distillation and reverse osmosis and for brackish waters using reverse osmosis and electrodialysis. Cost data were computed as a function of plant size and energy cost. The cost of generating steam and electrical energy on-site using coal fired boilers as well as oil fired boilers and dual purpose electric/seawater distillation plants is included. ERA

N78-23577# California Univ., Berkeley. Lawrence Berkeley Lab.
ERDA GEOTHERMAL COMPONENT TEST FACILITY (GCTF), EAST MESA, IMPERIAL VALLEY, CALIFORNIA. TEST OPERATIONS MANAGEMENT PLAN
1976 22 p refs
(Contract W-7405-eng-48)
(TID-28010) Avail: NTIS HC A02/MF A01

Discussion of the operation of the geothermal component test facility, established for testing heat extraction and energy conversion equipment and materials, is presented under the following section headings: purposes of the facility; operating policies: service, conflicts, safety and environmental, investigator activities, shops and equipment, and test certification; organization: chart; organization, responsibilities, individual responsibilities, and funding. ERA

N78-23578# Brookhaven National Lab., Upton, N. Y.
ENERGETICS OF THE UNITED STATES OF AMERICA: AN ATLAS
F. R. Drysdale and C. E. Calef Oct. 1977 447 p refs
(Contract EY-76-C-02-0016)
(BNL-50501-R) Avail: NTIS HC A19/MF A01

A description of the United States' energy system is presented in the form of maps and major tables. The country was chosen as the basic unit for reporting estimations of many energy, demographic and economic variables. The variables include production of all fuels (including hydroelectricity), uses of fuels and electricity broken down by sector and end-use, existing and planned electricity generation capacity, refinery capacities, and emissions of air pollutants from fuel use. ERA

N78-23579# Brookhaven National Lab., Upton, N. Y.
ENERGY INFORMATION AND ANALYTIC SYSTEM FOR NEW YORK STATE
T. O. Carroll, J. Allentuck, M. D. Goldberg, R. Nathans, P. F. Palmedo, R. Pouder, and D. Svei 9 Aug. 1976 98 p refs Prepared in cooperation with State Univ. of New York, Stony Brook
(Contract EY-76-C-02-0016)
(BNL-22677) Avail: NTIS HC A05/MF A01

A review of energy information needs and activities in New York and in 20 other states provided background for the types of policy issues and data critical to the design of an energy information/analytic system. The system was structured as a set of four basic elements; a broad base of state specified data and information, a computerized retrieval system with easy terminal access to national data bases, adaptation of useful analytical models, and a modular construction which will allow sequential development of full capacities of the total system. Author

N78-23580# Department of Energy, Washington, D. C.
ENERGY EMERGENCY PLANNING GUIDE: WINTER 1977 - 1978
Nov. 1977 177 p
(DOE/ERA/0031) Avail: NTIS HC A09/MF A01

This guide was prepared in order to identify and evaluate actions available to deal with energy emergencies this winter; provide an advance indication to the public of those actions

considered most likely to be taken by the government, and provide industry, state, and local governments with suggestions about actions which they can take to deal with energy emergencies. Flexible implementation guidelines are proposed for natural gas, petroleum, electricity/coal, and propane shortages. ERA

N78-23581# Hudson Inst., Inc., Croton-on-Hudson, N. Y.
SUGGESTIONS FOR A PHASE-2 NATIONAL ENERGY POLICY Final Report, Mar. - Sep. 1977
W. M. Brown and H. Kahn Sep. 1977 236 p
(Contract EF-77-C-01-2660)
(FE-2660-1) Avail: NTIS HC A11/MF A01

In order to obtain sufficient and secure long term supplies of oil and gas at stable prices a number of suggestions were made for the next phase of the U.S. energy program. The discussion emphasizes those relevant to the early requirements for the proposed synfuels program, the current domestic issues; particularly regulatory policy in the changing sociopolitical milieu, and some international approaches involving cooperation with the IEA and other fuel-importing countries, and the potential for cooperation as well as confrontation with OPEC. ERA

N78-23582# Argonne National Lab., Ill.
TRANSITION TO DECENTRALIZED ENERGY SYSTEMS
J. Cavallo and G. C. Krohm 1977 8 p refs Presented from 5th Natl. Conf. on Energy and the Environ. Cincinnati, 31 Oct. 1977
(Contract W-31-109-eng-38)
(CONF-7710101-1) Avail: NTIS HC A02/MF A01

Alternative system designs were compared for annualized costs and reliability. The alternative base and intermediate load generating plants tested were conventional large nuclear and coal units and small (120 MW) fluidized bed coal combustion units. ERA

N78-23583# Battelle Pacific Northwest Labs., Richland, Wash.
DEVELOPMENT, CHARACTERIZATION, AND EVALUATION OF MATERIALS FOR OPEN CYCLE MHD Quarterly Report, Mar. 1977
J. L. Bates Jun. 1977 112 p refs
(Contract EY-76-C-06-1830)
(BNWL-2004-6) Avail: NTIS HC A06/MF A01

Program objectives were to develop, test, characterize, and evaluate materials for open cycle, coal fired MHD power generators. The specific immediate goals emphasized electrode and insulator materials, including: (1) testing and evaluation of the enhanced effects of alkali seed on materials in a dc electric field; (2) development and testing of improved electrodes and insulators with controlled microstructures, compositions and properties; and (3) characterization and evaluation of materials relating to both the US MHD Program and the US-USSR Cooperative Program for MHD power generators. ERA

N78-23584# Argonne National Lab., Ill.
LONG-TERM AVAILABILITY OF WATER RESOURCES FOR ENERGY DEVELOPMENT IN THE CENTRAL UNITED STATES
L. J. Habegger, S. Y. Chiu, and L. J. Hoover 1977 9 p Presented at 5th Natl. Conf. on Energy and the Environ. Cincinnati, 31 Oct. 1977
(Contract W-31-109-eng-38)
(CONF-7710101-5) Avail: NTIS HC A02/MF A01

An analysis was made of water resources and demands over the next 40 to 50 years in the Central U.S. Various subregions in which significant water shortages are likely to occur were identified. These shortages would constrain energy development patterns, restrict development of competing water uses, or alternatively, require implementation of water resource enhancement options. ERA

N78-23585# Energy Research and Development Administration, Washington, D. C. Div. of Physical Research.
FOSSIL ENERGY RESEARCH MEETING
R. H. Kropschot and G. C. Phillips Dec. 1977 560 p Presented at Fossil Energy Research Meeting, Wash., D. C.
(CONF-7706100) Avail: NTIS HC A24/MF A01

Research programs in fossil energy were reviewed with brief descriptions, budgets, etc. Discussions related to the capabilities for such research of national laboratories, universities, energy centers, etc. are presented. ERA

N78-23586# Argonne National Lab., Ill. Chemical Engineering Div.
ANALYSIS OF THE HIGH-TEMPERATURE PARTICULATE COLLECTION PROBLEM
R. Razgaitis Oct. 1977 138 p refs
(Contract W-31-109-eng-38)
(ANL-77-14) Avail: NTIS HC A07/MF A01

Particulate agglomeration and separation at high temperatures and pressures were examined, with particular emphasis on the unique features of the direct cycle application of fluidized bed combustion. The basic long-range mechanisms of aerosol separation were examined, and the effects of high temperature and high pressure on usable collection techniques were assessed. Primary emphasis was placed on those avenues that were not currently attracting widespread research. The high temperature, particulate collection problem was surveyed, together with the peculiar requirements associated with operation of turbines with particulate-bearing gas streams. ERA

N78-23587# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
CENTRAL RECEIVER SOLAR THERMAL POWER SYSTEM. PHASE 1, CRDL ITEM 2: PILOT PLANT PRELIMINARY DESIGN REPORT. VOLUME 3, BOOK 2: COLLECTOR SUBSYSTEM
Raymon W. Hallet, Jr. and Robert L. Gervais Oct. 1977 454 p refs
(Contract EY-76-C-03-1108)
(SAN/1108-8/3; MDC-G-6776-Vol-3-Bk-2) Avail: NTIS HC A20/MF A01

The methods and plans for the manufacture of the 10 MW collector heliostats and associated controls for the pilot plant are given. An in depth description of the production, installation, and verification testing of heliostats for the pilot plant is presented. Specifications for the performance, design, and test requirements for the pilot plant collector subsystem are included. Also, a heliostat location summary report is given. ERA

N78-23588# Chase Manhattan Bank, New York. Energy Consulting Div.
US OIL AND NATURAL GAS FINDING COSTS. VOLUME 2: STATISTICAL APPENDIX
Jul. 1977 322 p Sponsored in part by DOE
(Contract FEA-CR-05-60731-00)
(FEA/G-77/357-Vol-2) Avail: NTIS HC A14/MF A01

Costs were established for U.S. oil and gas exploration efforts historically, and the level of such costs in 1980, 1985, and 1990 were projected. Data were developed for 17 onshore and 2 offshore regions in the Continental U.S. where the petroleum industry had traditionally focused its operations. Onshore and offshore sectors of Alaska as well as the offshore Atlantic Coast region that are the focal points of exploratory activity, were also examined. The research results are presented in terms of total dollar costs per foot drilled for oil and gas wells. ERA

N78-23589# Kentucky Univ., Lexington.
SURFACE STRUCTURE AND MECHANISMS OF GASIFICATION CATALYST DEACTIVATION Quarterly Report, Jan. - Apr. 1977
P. J. Reucroft, E. B. Bradley, R. J. DeAngelis, and G. A. Sargent Aug. 1977 72 p
(Contract EX-76-C-01-2229)
(FE-2229-5) Avail: NTIS HC A04/MF A01

NiS was found to have very little surface charging and small chemical shifts, compared to the Ni metal. A quantitative analysis of the L140 catalysts revealed that particle sizes did not change greatly with increasing metal loading; binding energies and peak shapes corresponded to a nickel aluminate complex. Catalysts were studied in order to assess the effects of exposure to synthesis gas and presulfiding. The presulfiding treatment effectively saturated the catalyst with sulfur. Thermal gravimetric analysis was used to study the effects of temperature and hydrogen flow rates on the reduction kinetics of NiO dispersed on silica and alumina supports. ERA

N78-23590# Michigan Univ., Ann Arbor. Dept. of Chemical Engineering.
STUDIES ON THE SEPARATION OF COAL EXTRACT FROM SOLID RESIDUE IN LIQUEFIED COAL Final Report
D. E. Briggs, D. B. McAlpine, C. D. Bedford, Benedict Ho, Phillip J. Johnson, Jeffrey A. McKeen, Uptal SenGupta, J. Andrew Stirling, Peter A. S. Smith, John R. Cameron et al Sep. 1977 458 p refs
(Grant NSF AER-75-15213; DRDA Proj. 013722)
(NSF/AER-75-15213) Avail: NTIS HC A20/MF A01

Coal liquefaction residues from the SYNTHOIL (Pittsburgh Seam) and H-Coal (Illinois No. 6) processes were fractionated by solvent extraction into oils and resins, asphaltenes, preasphaltenes, and mineral solids for adsorption, filtration, surface tension, and viscosity measurements. Suspended solids in liquefied coal range in size from less than 0.05 microns to greater than 1 microns. The specific resistance of filter cakes varies as an inverse function of the number average particle size. At temperatures below 200 C, the H-Coal filter cake compressibility was 0.36. The specific filtration resistance is temperature dependent above 200 C, being from 50 to 100 percent higher at 232 C than at 177 C. Surface tension and reduced viscosity data for oils, resins, and asphaltenes in tetralin indicate intermolecular association and colloid micellization. ERA

N78-23591# Institute of Gas Technology, Chicago, Ill.
PREPARATION OF A COAL CONVERSION SYSTEMS TECHNICAL DATA BOOK Monthly Status Report, 1-31 Aug. 1977
Oct. 1977 50 p refs
(Contract EX-76-C-01-2286; Proj. 8979)
(FE-2286-21) Avail: NTIS HC A03/MF A01

Various correlations for estimating the calorific value of coal from its elemental composition were compared using an extended data base of American coals. Charts that give partial pressures of NH3 and H2S in the NH3-H3S-H2O subsystem are presented. The equilibrium constants for reactions of interest in coal conversion processes are presented as functions of temperature. Correlations for saltation velocity in horizontal gas-solid transport are evaluated using available data on saltation velocities. Heat transfer coefficient curves are presented as functions of temperature for various solvent/coal ratios and fluid velocities. ERA

N78-23592# Rensselaer Polytechnic Inst., Troy, N. Y.
FEASIBILITY AND VIABILITY STUDY OF AN AIR COOLED, FOAM-INSULATED TRANSMISSION SYSTEM Final Report
A. Greenwood, John Anderson (G.E., Pittsfield, Mass.), and Nirmal Singh (G.E., Pittsfield, Mass.) Apr. 1977 118 p refs Sponsored by EPRI Prepared in cooperation with G. E., Pittsfield, Mass.
(EPRI-EL-532) Avail: NTIS HC A06/MF A01

Technical feasibility and economic viability of an underground power transmission system is described. The current carrying conductors of the system were relatively large diameter, thin walled aluminum tubes, which were mechanically supported and electrically insulated from each other and from ground by a closed cell, polyurethane foam. The transmission line was cooled by passing ambient air through the pipes between blower and exhaust stations at intervals along its length. ERA

N78-23593# Sandia Corp., Albuquerque, N. Mex. Computer-Aided Design Div.
PVSS: A PHOTOVOLTAIC SYSTEM SIMULATION PROGRAM MANUAL
Lawrence H. Goldstein and Glenn R. Case Jun. 1977 46 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0814) Avail: NTIS MF A01

The PVSS code was developed to accurately simulate the performance of a photovoltaic system. System configurations were modeled using such components as batteries, inverters, dc-voltage regulators, and maximum power point trackers. Data describing incident light intensity and load demand was supplied and, the PVSS program computed the power available at the output terminals of each system component, the energy surplus produced or deficit incurred by the system as a whole, and the battery state of charge for systems possessing battery storage. Procedures for defining a photovoltaic system and specifying a simulation are discussed. ERA

N78-23594# Resource Planning Associates, Inc., Washington, D. C.
COMPREHENSIVE COMMUNITY PLANNING FOR ENERGY MANAGEMENT AND CONSERVATION: DEVELOPING AND APPLYING A COORDINATED APPROACH TO ENERGY-RELATED COMMUNITY DEVELOPMENT, VOLUME 1
14 Oct. 1977 140 p
(Contracts EX-76-C-10-3879; E(49-1)-3879)
(HCP/M3879-Vol-1; RA-77-0319) Avail: NTIS HC A07/MF A01

Physical and institutional characteristics that determine a community's levels and patterns of energy use were defined and methods of coordinating its energy systems established. The characteristic problems of rapid growth are described and their causes traced. A number of domestic and European community development approaches that might be applicable to managing rapid growth in the boomtown context are surveyed. ERA

N78-23595# Resource Planning Associates, Inc., Washington, D. C.
COMPREHENSIVE COMMUNITY PLANNING FOR ENERGY MANAGEMENT AND CONSERVATION: DEVELOPING AND APPLYING A COORDINATED APPROACH TO ENERGY-RELATED COMMUNITY DEVELOPMENT, VOLUME 2
14 Oct. 1977 336 p
(Contracts EX-76-C-10-3879; E(49-1)-3879)
(HCP/M3879-1-Vol-2; RA-77-0319) Avail: NTIS HC A15/MF A01

Analytical outputs that shaped the general approach and its adaptation to the selected target community (Mercer County, North Dakota) were produced. Methodologies of the development of analytical tools and investigation of community-development approaches and the selection of communities are given. ERA

N78-23596# Resource Planning Associates, Inc., Washington, D. C.
COMPREHENSIVE COMMUNITY PLANNING FOR ENERGY MANAGEMENT AND CONSERVATION: DEVELOPING AND APPLYING A COORDINATED APPROACH TO ENERGY-RELATED COMMUNITY DEVELOPMENT: EXECUTIVE SUMMARY
Dec. 1977 36 p
(Contract E(49-1)-3879)
(HCP/M3879-0003) Avail: NTIS HC A03/MF A01

This summary highlights and condenses the community development process and formulates an organizational approach to resolving the institutional and financial issues arising from energy related community development. ERA

N78-23597# Battelle Pacific Northwest Labs., Richland, Wash.
EFFECT OF GENERALIZED WIND CHARACTERISTICS ON ANNUAL POWER ESTIMATES FROM WIND TURBINE GENERATORS
William C. Cliff Oct. 1977 57 p refs
(Contract EY-76-C-06-1830)
(PNL-2436) Avail: NTIS HC A04/MF A01

A technique is presented for estimating the average power output of a wind turbine using the mean annual wind magnitude. Hourly wind speeds were assumed to have a Rayleigh frequency distribution which required a single parameter input. Based upon a general shape, for the wind speed versus machine output, a generic set of curves was developed to estimate the average power output of wind turbines. ERA

N78-23598# Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.
THE MODULAR SOLAR ENERGY SATELLITE. PROJECT PROPOSAL AND DEVELOPMENT STRATEGY
Jan Ruth and Wolfgang Westphal [1977] 21 p refs In GERMAN; ENGLISH summary
Avail: NTIS HC A02/MF A01

The concept of a modular solar energy satellite (MOSES) for microwave energy transmission to earth is discussed. Economics can be obtained by using the modular concept proposed combined with part completion in space. The basic advantages

and disadvantages of the modular type structure are exemplified and a description is given of the range of the most suitable module forms. Research on possible construction methods shows that with advancing technologies an increasing use in time of space manufacturing will be feasible. An evolutionary development strategy is presented based on the use of the space shuttle/Spacelab research platform. ESA

N78-23599# Istituto Superiore di Sanita, Rome (Italy). Lab. delle Radiazioni.
HEALTH AND ENVIRONMENTAL ASPECTS OF ENERGY DEVELOPMENT
G. CamposVenuti, S. Frullani, E. Tabet, and P. Vecchia 30 Apr. 1977 67 p refs In ITALIAN; ENGLISH summary Presented at the 2d Intern. Meeting on Environ. Policy and Energy Crisis, Turin, 26-29 Apr. 1977
(ISS-P-77/2) Avail: NTIS HC A04/MF A01

Health and environmental aspects related to different energy sources were examined, both for those which are at present employed (fossil fuels and fission) and those still under development (solar, geothermal, fusion). The advantages of energy saving by using energy more efficiently are also analyzed. Author (ESA)

N78-23600# International Institute for Applied Systems Analysis, Laxenburg (Austria).
WHICH WAY TO GO? OBSERVATIONS BASED ON DISCUSSION ON GLOBAL PERSPECTIVES AND ENERGY STRATEGIES
W. Sassin, A. Lovins (Friends of the Earth), D. Meadows (Dartmouth Coll.), and P. Penczynski Sep. 1977 13 p refs (IIASA-PP-77-9) Avail: NTIS HC A02/MF A01

An attempt is made to trace some of the roots of the divergence of views on the approach to securing future energy demands. Research topics which could help to clarify the implications of alternate paths have been included. ESA

N78-23601# International Institute for Applied Systems Analysis, Laxenburg (Austria).
REPORT TO THE ADVISORY COMMITTEE OF IIASA'S ENERGY PROGRAM
W. Haefele, H. Porias, ed. et al Sep. 1977 42 p refs
(IIASA-RM-77-42) Avail: NTIS HC A03/MF A01

The general time scale, the general aims and concepts, and the present status of the ENP (Energy Systems Program) are reviewed. Specific activities and results of the ENP in energy models, coal potential, energy production and climate, and risk assessment are summarized. ESA

N78-23602# National Physical Lab., Teddington (England).
ENERGY AUDIT SCHEME Progress Report, 1 Jun. 1975 - 30 Nov. 1976
Aug. 1977 21 p refs
(NPL-Chem-72; PR-1) Avail: NTIS HC A02/MF A01

Progress on the Department of Industry Energy Audit Scheme (EAS) is reported. The scheme seeks to measure the energy used in the different stages of manufacture of industrial products, to identify areas of intensive wasteful energy use, and to provide information on the needs for research and development on the more efficient use of energy in industry. Industrial sectors covered are non-ferrous metals, mechanical engineering, electrical engineering, textiles, ceramics, paper, glass, and paint. Energy audits for all these sectors, except the paint sector, are presented. ESA

N78-23603# Oregon State Univ., Corvallis. Engineering Experiments Station.
SIMULATING OREGON'S FUTURE ELECTRICAL ENERGY DEMAND
W. D. Devine, Jr., C. C. Calligan, and O. D. Osborne Jul. 1977 232 p Sponsored by the Pacific Northwest Regional Commission
(PB-276970/1; BULL-54) Avail: NTIS HC A11/MF A01 CSCL 10B

An overview of the Oregon State Simulation Model (OSSIM), detailed documentation of OSSIM's energy component, a summary of liaison and training activities, and a discussion of model implementation are presented. GRA

N78-23604# Argonne National Lab., Ill.
SUPPORTIVE STUDIES IN FLUIDIZED-BED COMBUSTION Annual Report, Jul. 1976 - Jun. 1977
A. Jonke, G. Vogel, I. Johnson, S. Lee, J. Lenc, A. Lescarret, J. Montagna, F. Nunes, J. Shearer, and R. Snyder Dec. 1977 212 p refs
(Contract EPA-IAG-D5-e681)
(PB-276974/3; ANL/CEN/FE-77-3; EPA-600/7-77-138) Avail: NTIS HC A10/MF A01 CSCL 07A

The report gives results of studies supporting the development of atmospheric and pressurized fluidized-bed combustion (FBC) of coal. It includes laboratory and bench-scale studies to provide needed information on combustion optimization, regeneration process development, solid waste disposal, synthetic SO2-sorbent studies, emission control and other tasks. It includes characterization of a variety of limestone and dolomites from various parts of the U.S. for suitability in FB combustors. Reduction in solid waste volumes to reduce the environmental impact of the waste sulfated limestone is a major goal of this program. GRA

N78-23605# General Accounting Office, Washington, D. C. Energy and Minerals Div.
THE MAGNITUDE OF THE FEDERAL SOLAR ENERGY PROGRAM AND THE EFFECTS OF DIFFERENT LEVELS OF FUNDING
2 Feb. 1978 66 p
(PB-277018/8; EMD-78-27) Avail: NTIS HC A04/MF A01 CSCL 10A

The Federal solar energy program, its objectives, and major efforts are discussed; projected program costs through 1983; effects of increased/decreased funding on the solar energy program; and, mechanisms available to encourage the use of solar energy. GRA

N78-23606 National Technical Information Service, Springfield, Va.
FLUIDIZED BED COMBUSTION, VOLUME 1. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - 1976
Diane M. Cavagnaro Mar. 1978 224 p
(NTIS/PS-78/0194/7) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 21B

Fluidized bed processes for the combustion of coal, oil, and industrial and municipal wastes are covered. Sludge incineration, fluidized bed boilers, nuclear fuel reprocessing, and air pollution control are included. This updated bibliography contains 219 abstracts. GRA

N78-23607 National Technical Information Service, Springfield, Va.
FLUIDIZED BED COMBUSTION, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1970 - 1976
Diane M. Cavagnaro Mar. 1978 212 p
(NTIS/PS-78/0195/4) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 21B

This bibliography of worldwide research reports includes fluidized bed processes and processors for the combustion of oil, coal, and industrial as well as municipal wastes. The citations cover sludge incineration, fluidized bed boilers, and air pollution abatement by fluidized bed combustion. GRA

N78-23608 National Technical Information Service, Springfield, Va.
FLUIDIZED BED COMBUSTION, VOLUME 1. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1977 - Mar. 1978
Diane M. Cavagnaro Mar. 1978 110 p Supersedes NTIS/PS-77/0195 and NTIS/PS-76/0162
(NTIS/PS-78/0196/2; NTIS/PS-77-0195; NTIS/PS-76/0162) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 21B

For abstract, see N78-23607.

N78-23609 National Technical Information Service, Springfield, Va.
FLUIDIZED BED COMBUSTION, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1977 - Mar. 1978

Diane M. Cavagnaro Mar. 1978 135 p Supersedes NTIS/PS-77/0194; NTIS/PS-76/0161 and NTIS/PS-75/256
(NTIS/PS-78/0197/0; NTIS/PS-77/0194; NTIS/PS-76/0161; NTIS/PS-75/256) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 21B

The bibliography cites studies on fluidized bed processes and processors for the combustion of coal, oil, and industrial and municipal wastes. It also covers sludge incineration, fluidized bed boilers, nuclear fuel reprocessing, and air pollution control by fluidized bed combustion. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N78-23610 California Inst. of Tech., Pasadena.
AEROSOL DYNAMICS IN AN URBAN ATMOSPHERE Ph.D. Thesis
Thomas William Peterson 1978 267 p
Avail: Univ. Microfilms Order No. 78-03653

A steady state, three dimensional solution of the atmospheric diffusion equation including settling deposition, and first order removal is presented. The solution was applied to the prediction of airborne concentrations of gaseous and particulate pollutants in the case in which gases are converted to secondary particulate matter. The dynamic behavior of aerosol size distributions under the influence of coagulation and growth by heterogeneous condensation of gaseous species was studied. Analytical solutions were obtained to the integro-differential equation governing the aerosol size distribution density function. A detailed study of heterogeneous condensation on and reaction within an aerosol particle was undertaken. All important mechanisms governing the transfer of pollutants from the gas to the particulate phase are discussed. Dissert. Abstr.

N78-23611# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
RESIDENCE TIME OF ATMOSPHERIC POLLUTANTS AND LONG-RANGE TRANSPORT Final Report, May 1975 - Apr. 1977
Teizi Henmi, Elmar R. Reiter, and Roger Edson Jan. 1978 105 p refs
(Grant EPA-803685)
(PB-277168/1; EPA-600/4-78-003) Avail: NTIS HC A06/MF A01 CSCL 04A

The Lagrangian trajectory model which is suitable for the study of long range transport of pollutants, was developed. The computer program was capable of calculating trajectories over the region of the U.S. using routine sounding data. The scavenging coefficient of aerosols by cloudwater droplets was one order of magnitude larger in the continental cloud than in the maritime cloud. The scavenging coefficient of aerosols by rainwater droplets was slightly larger in maritime clouds than in continental clouds. Aerosols were more efficiently scavenged in the continental cloud than in the maritime cloud. GRA

N78-23612# Oak Ridge National Lab., Tenn. Environmental Sciences Div.
MODELING TECHNIQUES FOR PREDICTING LONG-TERM CONSEQUENCES OF THE EFFECTS OF RADIATION ON NATURAL AQUATIC POPULATIONS AND ECOSYSTEMS
Webster VanWinkle 1977 12 p refs Presented at Advisory Group on Methodology of Radiation Effects Experiments on Aquatic Organisms and Ecosystems for Evaluation, Vienna, 21-25 Nov. 1977
(Contract W-7405-eng-26)
(CONF-771115-2) Avail: NTIS HC A02/MF A01

Appropriate modeling techniques already exist for investigating some long-term consequences of the effects of radiation on natural aquatic populations and ecosystems, even if to date these techniques have not been used for this purpose. At the low levels of irradiation estimated to occur in natural aquatic systems, effects are difficult to detect at even the individual level much less the population or ecosystem level where the subtle effects of radiation are likely to be completely overshadowed by the effects of other environmental factors and stresses and the natural variability of the system. The claim that population and ecosystem models can be accurate and reliable predictive tools in assessing any stress has been oversold. Nonetheless, the use of these tools can be useful for learning more about the effects of radioactive release on aquatic populations and ecosystems. ERA

N78-23613# Oak Ridge National Lab., Tenn. Environmental Sciences Div.
POTENTIAL IMPACTS ON AQUATIC ECOSYSTEMS FROM THE RELEASE OF TRACE ELEMENTS IN GEOTHERMAL FLUIDS
R. M. Cushman, S. G. Hildebrand, and R. W. Brocksen Oct. 1977 26 p refs
(Contract W-7405-eng-26)
(ORNL-TM-6057; ESD-Publ-1097) Avail: NTIS HC A03/MF A01

Analyses of 14 trace elements found in hydrothermal fluids from various geothermal reservoirs in the western United States are presented. Potential impacts were assessed on the basis of toxicity to freshwater biota, and bioaccumulation in food fish to the point where consumption might be hazardous to human health. Trace element concentrations generally ranged from benign levels to levels which might prove toxic to freshwater biota and contaminate food fisheries. The need for site specific analyses and careful handling of geothermal fluids in order to minimize potential impacts is stressed. ERA

N78-23614# Meteorology Research, Inc., Altadena, Calif.
OXIDANT MEASUREMENTS IN WESTERN POWER PLANT PLUMES. VOLUME 1: TECHNICAL ANALYSIS Final Report
J. A. Ogren, D. L. Blumenthal, and A. H. Vanderpol Jul. 1977 119 p refs Sponsored by EPRI
(EPRI-EA-421-Vol-1) Avail: NTIS HC A06/MF A01

Airborne measurements were carried out at fossil fuel power plants in northwestern New Mexico. The extent of ozone formation in power plant plumes was ascertained. The formation of secondary pollutants NO2, SO4 was also studied. ERA

N78-23615# Department of Energy, Washington, D. C. Assistant Secretary for Policy and Evaluation.
THE L985 AIR POLLUTION EMISSIONS
Edward H. Pechan and Caldwell D. Meyers Dec. 1977 152 p
(DOE/PE/0001) Avail: NTIS HC A08/MF A01

Emissions were analyzed from point and area sources for each of the 243 Air Quality Control Regions in the United States using a computer assisted analytic procedure. Point sources primarily consist of industrial and utility fuel combustion, industrial process emissions, and other large sources while area sources primarily consist of transportation sources (mainly automobiles) and small fuel combustion sources. Five criteria pollutants were analyzed in detail: total suspended particulates, sulfur oxides, nitrogen oxides, hydrocarbons, and carbon monoxide. In addition, a preliminary estimate was made of discharges of selected toxic/hazardous pollutants to air for the nation from industrial and utility boilers. Results indicate that the primary difference between environmental emissions of initiative and nominal provisions is a change in the distribution rather than in absolute values. ERA

N78-23616# Air Pollution Technology, Inc., San Diego, Calif.
FINE PARTICLE COLLECTION BY A FLUX-FORCE/CONDENSATION SCRUBBER: PILOT DEMONSTRATION Final Report, Jun. 1974 - Jun. 1977
Seymour Calvert and Shamin Gandhi Dec. 1977 193 p refs
(Contract EPA-68-02-1869)
(PB-277075/8; EPA-600/2-77-238) Avail: NTIS HC A09/MF A01 CSCL 07A

Results of a pilot-scale demonstration of flux-force/condensation (FF/C) scrubbing for fine particle control, carried out on secondary metal recovery furnaces are given. The system was generally capable of 90-95% efficiency on particles with a mass median aerodynamic diameter of 0.7-0.8 micrometers A, achieved with a 68 cm W.C. gas-phase pressure drop. Mathematical models were developed for predicting FF/C effects and for

use in scrubber system design. The report gives FF/C system design details, experimental results, analysis of results, description of mathematical models, design of an optimized system, cost estimates, and recommendations for future research. GRA

N78-23617# Radian Corp., Austin, Tex.
PRECIPITATION CHEMISTRY OF MAGNESIUM SULFITE HYDRATES IN MAGNESIUM OXIDE SCRUBBING Final Task Report, Jul. 1975 - Dec. 1976
Phillip S. Lowell, Frank B. Meserole, and Terry B. Parsons Sep. 1977 377 p refs
(Contract ERA-68-02-1319)
(PB-277086/5; EPA-600/7-77-109) Avail: NTIS HC A17/MF A01 CSCL 07D

The report gives results of laboratory studies defining the precipitation chemistry of MgSO3 hydrates. The results apply to the design of Mg based scrubbing processes for SO2 removal from combustion flue gas. Nucleation plays a dominant role in the formation of trihydrate solids. Results indicate that Mg-based precipitate a majority of either hydrate form. Important design variables include scrubbing liquor composition and temperature, seed crystal composition, slurry volume, equipment residence times, and energy inputs to the slurry that influence nucleation. GRA

N78-23618# Environmental Protection Agency, Ann Arbor, Mich. Emission Control Technology Div.
RECOMMENDED PRACTICE FOR MEASUREMENT OF EXHAUST SULFATE EMISSION FROM LIGHT-DUTY VEHICLES AND TRUCKS
Sep. 1977 97 p ref
(PB-277638/3) Avail: NTIS HC A05/MF A01 CSCL 07D

Various test procedures for the measurement of exhaust sulfate (measured as sulfuric acid) emission from light-duty vehicles and trucks are described. Several test sequences were examined and the conclusion was reached that the sulfuric acid test should follow the exhaust emission measurements in the test sequence. GRA

N78-23619# Southern Research Inst., Birmingham, Ala.
PARTICULATE CONTROL HIGHLIGHTS: AN ELECTROSTATIC PRECIPITATOR PERFORMANCE MODEL Final Task Report, Nov. 1976 - Nov. 1977
J. McDonald and L. Felix Dec. 1977 17 p
(Contract EPA-68-02-2114)
(PB-277221/8; SORI-EAS-77-675; EPA-600/8-77-020b) Avail: NTIS HC A02/MF A01 CSCL 07D

A computerized mathematical model that can be used to estimate the collection efficiency of electrostatic precipitators (ESPs) of different designs, operating under various conditions is described. (ESPs are widely used to control emissions of fly ash and other dusts from industrial sources.) Mathematical expressions based on theory are used to calculate electric fields and dust particle charging rates. Empirical corrections are made for nonideal effects such as non-uniform gas velocity distribution. The model is expected to aid in improving ESP design and in selecting optimum ESP operating conditions. GRA

N78-23620 National Technical Information Service, Springfield, Va.
THERMAL POLLUTION. PART 1: CONTROL TECHNIQUES AND GENERAL STUDIES. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Feb. 1978
Robena J. Brown Mar. 1978 211 p Supersedes NTIS/PS-77/0184; NTIS/PS-76/0127; NTIS/PS-75/218
(NTIS/PS-78/0171/5; NTIS/PS-77/0184; NTIS/PS-76/0127; NTIS/PS-75/218) Avail: NTIS HC $28.00/MF $28.00 CSCL 13G

Reports concerned with control techniques for heated effluents from power and industrial plants are cited. Also included are studies on general thermal pollution problems and their abatement. Many reports on the remote sensing of thermal effluents are also cited. GRA

N78-23621 National Technical Information Service, Springfield, Va.
THERMAL POLLUTION. PART 2: BIOLOGICAL EFFECTS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1974 - Feb. 1978
Robena J. Brown Mar. 1978 214 p Supersedes NTIS/PS-77/0185; NTIS/PS-76/0129; NTIS/PS-75/219
(NTIS/PS-78/0172/3; NTIS/PS-77/0185; NTIS/PS-76/0129; NTIS/PS-75/219) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

Abstracts covering the effects of heated effluents on fish, shellfish, microorganisms, and plants in both fresh and salt water are presented, including the effects on growth, ecology, metabolism, heat tolerance, and productivity. The effluent sources are both power and industrial plants. GRA

N78-23622 National Technical Information Service, Springfield, Va.
THERMAL POLLUTION. PART 3: HYDROLOGY AND HYDRODYNAMICS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Feb. 1978
Robena J. Brown Mar. 1978 218 p Supersedes NTIS/PS-77/0186; NTIS/PS-76/0130; NTIS/PS-75/220
(NTIS/PS-78/0173/1; NTIS/PS-77/0186; NTIS/PS-76/0130; NTIS/PS-75/220) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

Aspects of the hydrology and hydrodynamics of heated effluents are covered in the bibliography, including mixing, diffusion, modeling, heat transfer, and flow. GRA

N78-23623 National Technical Information Service, Springfield, Va.
AUTOMOBILE AIR POLLUTION: NEW AUTOMOTIVE ENGINES AND ENGINE IMPROVEMENTS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1970 - Mar. 1978
Diane M. Cavagnaro Mar. 1978 186 p Supersedes NTIS/PS-77/0227; NTIS/PS-76/0187; NTIS/PS-75/312
(NTIS/PS-78/0208/5; NTIS/PS-77/0227; NTIS/PS-76/0187; NTIS/PS-75/312) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

Designs of automobile engines are presented. The engine types include gas turbines; stratified charged engines; steam engines; hybrid engines using electric motors of flywheels; and rotary engines. Improving fuel economy while lowering emissions were examined, and rotrofit devices were excluded. GRA

N78-23624 National Technical Information Service, Springfield, Va.
AUTOMOBILE AIR POLLUTION: PUBLIC HEALTH. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Mar. 1978
Pernell W. Crockett Mar. 1978 56 p Supersedes NTIS/PS-77/0226; NTIS/PS-76/0190
(NTIS/PS-78/0209/3; NTIS/PS-77/0226; NTIS/PS-76/0190) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

Human effects of the major components of automobile exhaust gases were investigated. These include carbon monoxide, nitrogen oxides, aldehydes, hydrocarbons, and lead. Also included are data on platinum, palladium, and manganese salts, which are exhausts from air pollution control devices, specifically catalytic converters. GRA

N78-23625 National Technical Information Service, Springfield, Va.
AUTOMOBILE AIR POLLUTION: ATMOSPHERIC MOTION. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1970 - Mar. 1978
Diane M. Cavagnaro Mar. 1978 105 p Supersedes NTIS/PS-77/0225; NTIS/PS-76/0189; NTIS/PS-75/314
(NTIS/PS-78/0210/1; NTIS/PS-77/0225; NTIS/PS-76/0189; NTIS/PS-75/314) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

The modeling, diffusion, and motion of motor vehicle exhaust emissions are presented. GRA

N78-23626 National Technical Information Service, Springfield, Va.
AUTOMOBILE AIR POLLUTION: ABATEMENT THROUGH MANAGEMENT AND PLANNING. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1970 - Mar. 1978
Diane M. Cavagnaro Mar. 1978 229 p refs Supersedes

NTIS/PS-77/0235; NTIS/PS-76/0183 and NTIS/PS-75/309 (NTIS/PS-78/0234/1; NTIS/PS-77/0235; NTIS/PS-76/0183; NTIS/PS-75/309) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 07D

Planning and management studies for the abatement of air pollution from automobiles are covered. These include reports covering maintenance and inspecting programs, emission factors, urban planning related to pollution, Government policies, and the effects of these strategies on citizens and urban growth. Reports which give background information pertinent to such abatement decisions are also cited. GRA

N78-23627 National Technical Information Service, Springfield, Va.

AUTOMOBILE AIR POLLUTION: AUTOMOTIVE FUELS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1970 - Mar. 1978

Diane M. Cavagnaro Mar. 1978 214 p Supersedes NTIS/PS-77/0230; NTIS/PS-76/0188 and NTIS/PS-75/313 (NTIS/PS-78/0235/8; NTIS/PS-77/0230; NTIS/PS-76/0188; NTIS/PS-75/313) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 07D

The use of fuels and fuel additives to reduce pollution from automobiles is covered in this bibliography. The use of methyl alcohol, natural gas, methane, and hydrogen is reported. Improvements to gasoline and its properties which affect air pollution are discussed, along with studies on lead additives. GRA

N78-23628 National Technical Information Service, Springfield, Va.

AIR POLLUTION TRACER STUDIES IN THE LOWER ATMOSPHERE. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Feb. 1978

Diane M. Cavagnaro Mar. 1978 125 p Supersedes NTIS/PS-77/0180; NTIS/PS-76/0144 (NTIS/PS-78/0183/0; NTIS/PS-77/0180; NTIS/PS-76/0144) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 04A

The cited reports cover research on the use of tracers to study lower atmospheric air pollution movements. The tracers used include sulfur hexafluoride, krypton 85, carbon 14, and other radioactive isotopes. The studies cite the results and techniques used, tracer movement from nuclear power plants, industrial stacks, urban areas, and the detectors used in their measurement. GRA

N78-23629 National Technical Information Service, Springfield, Va.

THE BIOLOGICAL EFFECTS OF OIL SPILLS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Feb. 1978

Elizabeth A. Harrison Mar. 1978 247 p Supersedes NTIS/PS-77/0200; NTIS/PS-76/0033; NTIS/PS-75/118 (NTIS/PS-78/0193/9; NTIS/PS-77/0200; NTIS/PS-76/0033; NTIS/PS-75/118) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 06F

Aspects of the biological and ecological effects of oil spills in salt and fresh water are covered. The effects on microorganisms, plants, and animals are studied, along with the residues and metabolic products of various oil components. This updated bibliography contains 242 abstracts. GRA

N78-23630 National Technical Information Service, Springfield, Va.

DETECTION AND SAMPLING IN FLUE GASES. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Mar. 1978

Diane M. Cavagnaro Mar. 1978 267 p Supersedes NTIS/PS-77/0172; NTIS/PS-75/828 (NTIS/PS-78/0176/4; NTIS/PS-77/0172; NTIS/PS-75/828) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 07D

The detection and sampling of combustion product flue gases within the stack and at the stack exit are covered. Detector design is included, along with detection techniques for all types of possible pollutants, including NOx, NO2, CO, and particulates. This updated bibliography contains 262 abstracts. GRA

N78-23631# National Oceanic and Atmospheric Administration, Idaho Falls, Idaho. Air Resources Labs.

A FEASIBILITY STUDY FOR THE APPLICATION OF K-BAND RADAR IN THE INVESTIGATION OF COOLING TOWER PLUMES

Norman R. Ricks Aug. 1977 45 p refs (PB-275380/4; NOAA-TM-ERL-ARL-66; NOAA-77110803) Avail: NTIS HC A03/MF A01 CSCL 13B

Commercially available systems were evaluated by means of a computer model which estimated the strength of the expected return signal under sampled conditions known to exist in actual plumes. Recommendations were made for the adaptation of available radar systems and for areas of additional study. Complete data and program documentation are provided. GRA

N78-23632# Tetra Tech, Inc., Lafayette, Calif.

WATER QUALITY ASSESSMENT: A SCREENING METHOD FOR NONDESIGNATED 208 AREAS

Stanley W. Zison, Kendall F. Haven, and William B. Mills Aug. 1977 1217 p refs (Grant EPA-R-804450) (PB-277161-6; EPA-600/9-77-023) Avail: NTIS HC A99/MF A01 CSCL 13B

Analytical methods were included for the assessment of rivers, impoundments, and estuaries. Additionally, methods were provided by which point and nonpoint sources were evaluated. The water quality parameters analyzed for all three water body types were biochemical oxygen demand, dissolved oxygen, temperature, and sediment accumulation. GRA

N78-23633# Donaldson Co., Inc., Minneapolis, Minn.

PARTICULATE CONTROL WITH CLEANABLE CARTRIDGE FILTER USING DOUBLE-LAYER MEDIA Final Report, Jun. 1975 - Oct. 1977

William J. Krisko and Michael A. Shackleton Dec. 1977 196 p refs (Contract EPA-68-02-1878) (PB-276976/8; EPA-600/7-77-140) Avail: NTIS HC A09/MF A01 CSCL 13K

The feasibility of fine particle filtration, nonwoven, double-mat, cartridge filters consisting of a fine fiber filtration layer supported by a porous substrate providing physical strength to the resulting filtration media was a theoretical basis for fine particle control with this media is presented. Test results with 0.3 micrometer DOP smoke confirmed that the design objective of 90% collection efficiency was obtainable. Preliminary economic analysis indicates that the cartridge filter will be less costly than the standard baghouse. Both laboratory and field tests proved the media capable of high dust removal efficiency of fine particles (less than or equal to 3 micrometers) while achieving good pulse-jet cleaning characteristics. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N78-23634 Arizona Univ., Tucson.

DETERMINATION OF THE COMPLEX REFRACTIVE INDEX OF ATMOSPHERIC AEROSOLS BY THE DIFFUSE-DIRECT TECHNIQUE: A STATISTICAL PROCEDURE Ph.D. Thesis

Michael Dumont King 1977 160 p Avail: Univ. Microfilms Order No. 7805681

An experiment was performed to measure the hemispheric diffuse and directly transmitted solar flux density at several solar zenith angles throughout the day. From these measurements, the ground albedo and the effective imaginary term of the complex refractive index of atmospheric particulates were inferred. A method is presented for obtaining the total ozone content of the atmosphere from wavelength measurements of the directly transmitted solar flux density at varying solar zenith angles. A statistical technique for inferring the optimum values of the ground albedo and index of absorption from measurements of the diffuse-direct ratio was developed. The procedure utilizes a

semi-analytic gradient search method from least squares theory and includes a detailed error analysis. Dissert. Abstr.

N78-23635 Ohio State Univ., Columbus.
A NUMERICAL SIMULATION OF THE ANNUAL CYCLE OF SEA ICE IN THE ARCTIC AND ANTARCTIC Ph.D. Thesis
Claire Lucille Parkinson 1977 207 p
Avail: Univ. Microfilms Order No. 78-05905

The construction of and results from a numerical model simulating the yearly cycle of sea ice in both the northern and southern hemispheres are described. The model employed a rectangular grid with 200 km horizontal resolution, and 8 hr timestep, and four vertical layers; ice, snow, ocean, and atmosphere. Both thermodynamic and dynamic processes were incorporated, and, although the ice within a given grid square was of uniform thickness, there was an allowance for leads, the percentage of open water within a grid square being recalculated each timestep. Dissert. Abstr.

N78-23636 Arizona Univ., Tucson.
MONITORING OF TROPOSPHERIC AEROSOL OPTICAL PROPERTIES BY LASER RADAR Ph.D. Thesis
James Dale Spinhirne 1977 189 p
Avail: Univ. Microfilms Order No. 78-05671

Analytic and experimental techniques which allowed quantitative laser radar, or lidar, measurement of the extent and optical properties of atmospheric aerosol particles within the troposphere were developed and applied. Pulsed elastic backscatter ruby lidar was used to routinely measure the vertical profile of particulate extinction and backscatter cross section in the troposphere. Results from these measurements are presented, and subsequently some of these data are used in conjunction with solar radiometer measurements to infer the upper limit of particulate absorption index for the lower troposphere. Dissert. Abstr.

N78-23637 Michigan Univ., Ann Arbor.
AN EFFICIENT METHOD FOR INVERTING LIMB RADIANCE PROFILES WITH APPLICATION TO THE FLUOROCARBONS Ph.D. Thesis
John David Mill 1977 148 p
Avail: Univ. Microfilms Order No. 7804771

Solar occultation, a method in which a satellite radiometer was used to measure the extinction of solar radiation as a function of the altitude of the lowest point of the path, the tangent point, is presented. The method was used to examine the feasibility of measuring the vertical concentration profiles of the fluorocarbons, CF2Cl2 and CFCl3, by solar occultation. Dissert. Abstr.

N78-23638 Michigan Univ., Ann Arbor.
A NUMERICAL STUDY DESCRIBING REGIONAL MODIFICATION OF THE ATMOSPHERE BY THE GREAT LAKES Ph.D. Thesis
Douglas Bryant Boudra 1977 229 p
Avail: Univ. Microfilms Order No. 7804654

The nature and extent of air mass modification due to large deep inland lakes of the midlatitudes was investigated. A simple system was examined, considering only the water vapor equation, and neglecting all terms except the local tendency and the convergence of the vertical turbulent eddy flux. The character of the circulation is described through the associated vorticity and divergence fields and its existence is explained in terms of the components of the lake effect. The current results were compared with those of previous observational numerical studies of lake effects, and suggestions were made for further study.
Dissert. Abstr.

N78-23639 California Univ., San Diego.
FINITE ELEMENT ANALYSIS OF SEISMIC SCATTERING PROBLEMS Ph.D. Thesis
Steven Milton Day 1977 165 p
Avail: Univ. Microfilms Order No. 7805741

The finite element method was extended to treat general three-dimensional elastic wave fields in axisymmetric media. This is accomplished by expanding the azimuthal dependence of the dependent variables as Fourier series. Efficacy of the method is evaluated by comparing numerical solutions to analytical solutions for the problems of radiation from a double-couple in a half-space and radiation from a shear stress relaxation on a growing circular fault plane. Capabilities of the method are illustrated for a number of problems involving the scattering of seismic waves.
Dissert. Abstr.

N78-23640 Wisconsin Univ., Madison.
THE COUPLING OF UPPER AND LOWER TROPOSPHERIC JET STREAKS AND IMPLICATIONS FOR THE DEVELOPMENT OF SEVERE CONVECTIVE STORMS Ph.D. Thesis
Louis William Uccellini 1977 150 p
Avail: Univ. Microfilms Order No. 7728278

The interaction between upper and lower tropospheric jet streaks was studied to determine important subsynoptic scale adjustments that establish conditions favorable for the development of severe convective storms. The mass and momentum adjustments associated with the transverse circulations in the entrance and exit regions of a propagating upper tropospheric jet streak were investigated through numerical and case study results. The forcing of the lower tropospheric return branches of the transverse circulations was determined by an application of the isallobaric wind equation in the isentropic framework and is related directly to the two layer mass adjustment associated with the propagating jet streaks. Dissert. Abstr.

N78-23641 Michigan Univ., Ann Arbor.
METHODS AND APPLICATIONS OF BIFURCATION THEORY TO LARGE SCALE ATMOSPHERIC INSTABILITIES Ph.D. Thesis
Joseph Jude Tribbia 1977 135 p
Avail: Univ. Microfilms Order No. 78-04826

The mathematical formalism necessary for the treatment of fluid dynamic bifurcations as nonlinear initial value problems is given. The major restriction on this analysis is that the instability under study be capable of being faithfully simulated by a Galerkin model. Two types of systems are considered leading, respectively, to damped and inviscid bifurcations. The results of the initial value formulation are compared to more commonly used techniques. Dissert. Abstr.

N78-23642 Michigan Univ., Ann Arbor.
THE VIBRATIONALLY EXCITED N2(+) ION AND THE TWILIGHT 4278 A EMISSION BAND IN THE EARTH'S MID-LATITUDE THERMOSPHERE Ph.D. Thesis
Nicola Orsini 1977 171 p
Avail: Univ. Microfilms Order No. 7804787

The conventional photochemical N2(+) theory in the thermosphere was reviewed. Comparisons were made between theory and measurement using the data base collected by the Atmosphere Explorer-C(AE-C) satellite over a period of one year from early 1974 to early 1975. Dissert. Abstr.

N78-23643 Engineering Sciences Data Unit, London (England).
PROPERTIES OF A STANDARD ATMOSPHERE
Oct. 1977 21 p
(ESDU-77021; ISBN-0-85679-193-8) For information on availability of series, sub-series, and other individual data items, write NTIS, attn: ESDU, Springfield, Va. 22161. HC $338.50

Data on the properties of the atmosphere for heights up to 1000 km are presented by ESDU. It also provides expressions from which the properties may be calculated directly. The atmosphere considered in the term was an idealized, mean annual, steady state model assumed to exist in a period of moderate solar activity at a latitude of about 45 degrees N and to rotate with the earth. The effects of dust and moisture in the atmosphere were neglected. Author

N78-23644*# TRW Defense and Space Systems Group, Redondo Beach, Calif. Space Sciences Staff.
ONGOING DATA REDUCTION, THEORETICAL STUDIES Final Report
F. L. Scarf and F. W. Greenstadt 30 Apr. 1978 32 p refs (Contract NASw-3087)
(NASA-CR-157005; TRW-31219-6007-RU-00) Avail: NTIS HC A03/MF A01 CSCL 04A

A nonspecific review of theory, correlative date analysis and supporting research and technology is presented. Title pages in some of the following areas are included: (1) magnetosphere boundary observations; (2) venus ionosphere and solar wind

interaction; (3) ISEE-C plasma wave investigation, and (4) solar system plasmas. B.B.

N78-23645*# Stanford Research Inst., Menlo Park, Calif.
IONOSPHERIC SCINTILLATION STUDIES Final Report, 10 Nov. 1972 - 10 Nov. 1973
C. L. Rino and E. J. Freemouw Nov. 1973 127 p refs
(Contract NAS5-21891; SRI Proj. 2273)
(NASA-CR-156752) Avail: NTIS HC A07/MF A01 CSCL 04A

The diffracted field of a monochromatic plane wave was characterized by two complex correlation functions. For a Gaussian complex field, these quantities suffice to completely define the statistics of the field. Thus, one can in principle calculate the statistics of any measurable quantity in terms of the model parameters. The best data fits were achieved for intensity statistics derived under the Gaussian statistics hypothesis. The signal structure that achieved the best fit was nearly invariant with scintillation level and irregularity source (ionosphere or solar wind). It was characterized by the fact that more than 80% of the scattered signal power is in phase quadrature with the undeviated or coherent signal component. Thus, the Gaussian-statistics hypothesis is both convenient and accurate for channel modeling work. Author

N78-23646*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
SOIL MOISTURE MODELING REVIEW
W. W. Hildreth Apr. 1978 32 p refs
(Contract NAS9-15200)
(NASA-CR-151716; LEC-11857) Avail: NTIS HC A03/MF A01 CSCL 08M

A determination of the state of the art in soil moisture transport modeling based on physical or physiological principles was made. It was found that soil moisture models based on physical principles have been under development for more than 10 years. However, these models were shown to represent infiltration and redistribution of soil moisture quite well. Evapotranspiration has not been as adequately incorporated into the models. Author

N78-23647*# AeroChem Research Labs., Inc., Princeton, N. J.
A SIMULATION MODEL OF THE PLANETARY BOUNDARY LAYER AT KENNEDY SPACE CENTER Final Report, 24 Jun. 1977 - 28 Mar. 1978
BaoChuan Hwang Mar. 1978 23 p refs
(Contract NAS1-14987)
(NASA-CR-145357; Aerochem-TP-369) Avail: NTIS HC A02/MF A01 CSCL 04A

A simulation model which predicts the behavior of the Atmospheric Boundary Layer has been developed and coded. The model is partially evaluated by comparing it with laboratory measurements and the sounding measurements at Kennedy Space Center. The applicability of such an approach should prove quite widespread. Author

N78-23648*# Control Data Corp., Minneapolis, Minn. Research Div.
VARIABILITY OF OZONE NEAR THE TROPOPAUSE FROM GASP DATA Research Report
G. D. Nastrom 14 Apr. 1978 50 p refs
(Contract NAS3-20618)
(NASA-CR-135405; RR-1) Avail: NTIS HC A03/MF A01 CSCL 04A

The first 22 months of ozone data from the Global Atmospheric Sampling Program are summarized. Variations in space and time were examined at nearly all scales permitted by the data. Case studies in the tropics suggest that local ozone maxima may be found in or near clouds. Preliminary seasonal mean maps of ozone during spring are presented for the Northern Hemisphere. In the troposphere over the United States during summer there is a distinct midcontinental ozone maximum. There is a diurnal variation in ozone in the upper troposphere and the daily range is about 5 ppbv. Correlations between ozone and other variables are given for the synoptic-scale and on a hemispheric scale. The possible bearing of these results on ozone transport computations is discussed. Author

N78-23649*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NUMERICAL AND LABORATORY SIMULATION OF FAULT MOTION AND EARTHQUAKE OCCURRENCE
Steven C. Cohen Apr. 1978 55 p refs
(NASA-TM-78111) Avail: NTIS HC A04/MF A01 CSCL 08G

Simple linear rheologies were used with elastic forces driving the main events and viscoelastic forces being important for aftershock and creep occurrence. Friction and its dependence on velocity, stress, and displacement also plays a key role in determining how, when, and where fault motion occurs. The discussion of the qualitative behavior of the simulators focuses on the manner in which energy was stored in the system and released by the unstable and stable sliding processes. The numerical results emphasize the statistics of earthquake occurrence and the correlations among source parameters. Author

N78-23650# Geophysical Observatory, Christchurch (New Zealand). Physics and Engineering Lab.
A PROGRAM FOR READING IONOSPHERIC DATA
L. A. Tomlinson Nov. 1977 109 p
(Rept-540) Avail: NTIS HC A06/MF A01

A PDP 11 minicomputer with an XY digitising table was programmed so that the relevant points from a record were directly entered into the computer. The data were stored in a file on disk for subsequent processing and finally the production of tabulated data sheets for publication. Author

N78-23651# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
AN ANALYSIS OF EARTHQUAKE INTENSITIES WITH RESPECT TO ATTENUATION, MAGNITUDE, AND RATE OF RECURRENCE, REVISED EDITION Final Report
Rutlage J. Brazee Aug. 1976 104 p
(Contract AT(49-25)-1004)
(PB-277789/4; NOAA-TM-EDS-NGSDC-2; NOAA-78010401) Avail: NTIS HC A06/MF A01 CSCL 08K

Earthquakes intensity reports collected by various agencies of the U.S. Government from many thousand localities for the years 1928 through 1973 were encoded and filed on magnetic tape. A method for determing systematically the isoseismal areas and distances was developed and used for the analysis of intensity attenuation. A method of calculating recurrence curves is presented, which permits the determination of such a curve by electronic computer/plotter for any point in the conterminous United States. GRA

N78-23652# Computer Sciences Corp., Arlington, Va.
ANALYSIS OF A WORLDWIDE STRONG MOTION DATA SAMPLE TO DEVELOP AN IMPROVED CORRELATION BETWEEN PEAK ACCELERATION, SEISMIC INTENSITY AND OTHER PHYSICAL PARAMETERS
J. R. Murphy and L. J. OBrien Jan. 1978 104 p refs
(Contract AT(49-24)-0362)
(PB-276361/3; NUREG-0402) Avail: NTIS HC A06/MF A01 CSCL 08K

A data base consisting of nearly 1600 accelerograms was assembled from the Western U.S., Japan, Southern Europe, and New Guinea. Statistical analysis of the accelerograms led to an equation in which maximum acceleration is a function of intensity, magnitude, and epicentral distance. Using both theoretical models and specific examples, variations in site ground motion responses were shown to be dependent on the thickness of the alluvium beneath the recording station. GRA

N78-23653# Airborne Research Associates, Weston, Mass.
AIRCRAFT MEASUREMENTS WITHIN THE PLANETARY BOUNDARY LAYER OVER WATER Final Report
Ralph Markson Oct. 1977 114 p refs
(Contract N00019-76-C-0588)
(AD-A052077) Avail: NTIS HC A06/MF A01 CSCL 04/1

The basic overall objective of the program has been to develop a relatively inexpensive airborne sensing system for study of the marine boundary layer in support of the NAVAIR Marine Fog Investigation. This extends into the third dimension measurement of most of the significant parameters which have been studied from ships and land stations. The operational flexibility of the

aircraft operation has made possible precision dives at constant slant angles to very low altitude over electro-optical sensing instruments at the Naval Surface Weapons Center, Dahlgren, as well as flight into fog at the sea surface in order to obtain complete soundings. The catalogues of soundings forming the appendices of this report offer a unique body of data characterizing the marine boundary layer over the waters surrounding the United States. GRA

N78-23654# Air Force Geophysics Lab., Hanscom AFB, Mass.
ATLAS OF CLOUD-FREE LINE-OF-SIGHT PROBABILITIES. PART 3: UNITED STATES OF AMERICA
Iver A. Lund, Donald D. Grantham, and Clarence B. Elam, Jr. 24 Aug. 1977 74 p refs
(AF Proj. 8624)
(AD-A051112; AFGL-TR-77-0188-Pt-3; AFGL-AFSG-374) Avail: NTIS HC A04/MF A01 CSCL 04/1

This is the third part of a planned Northern Hemisphere atlas of probabilities of cloud-free lines-of-sight between the earth and space. The probabilities are for the mid-season months: January, April, July, and October; four times of day: 00000200 LST, 0600-0800 LST, 1200-1400 LST, and 1800-2000 LST; and three elevation angles: 10, 30, and 90 degrees. Parts 1 and 2 depicted cloud-free line-of-sight probabilities for Germany and the USSR respectively. Author (GRA)

N78-23655# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
AVAILABLE ENERGY AND THE MAINTENANCE OF A MOIST CIRCULATION Final Report, 1 Nov. 1976 - 31 Oct. 1977
Edward N. Lorenz Dec. 1977 29 p
(Contract F19628-77-C-0026)
(AD-A051136; AFGL-TR-76-0007) Avail: NTIS HC A03/MF A01 CSCL 04/2

Moist available energy is defined as the amount by which the potential plus internal (including latent) energy of a given atmospheric mass field exceeds that of a hypothetical reference field, which can be constructed from the given field by rearranging the atmospheric mass, under reversible dry-adiabatic and moist-adiabatic processes, to minimize the potential plus internal energy. Dry available energy is equal to the amount of moist available energy which would be present in a dry atmosphere having the same temperature field as the given moist atmosphere, and is identical with available potential energy. Graphical procedures are presented for determining the moist and dry reference fields and evaluating the available energies. In general the moist available energy exceeds the dry available energy. Both heating and cooling can produce and can also destroy moist and dry available energy. Evaporation can produce moist available energy, while precipitation can destroy it. Preliminary computations based upon averages indicate that the total production of moist available energy by evaporation-precipitation is at least as great as the production by heating-cooling, and possibly much greater. Author (GRA)

N78-23656# Army Electronics Command, Fort Monmouth, N. J.
AN OPTICAL DEVICE FOR MEASURING REFRACTIVE-INDEX FLUCTUATION IN THE ATMOSPHERE
G. R. Ochs, R. F. Quintana, and G. F. Miller Oct. 1977 13 p
(AD-A051435; ECOM-77-9) Avail: NTIS HC A02/MF A01 CSCL 04/1

An instrument is described that measures the average value of the refractive-index structure constant (C sub n squared) over optical paths from 80 to 800 meters. Corrections for the inner scale of turbulence and difficulties due to the saturation of scintillation, both present in previous optical techniques, are avoided by using an extended incoherent light source.
Author (GRA)

N78-23657# Logicon, Inc., Lexington, Mass.
ANALYSIS AND RESEARCH FOR INTEGRATED SYSTEMS IN PHYSICS OF THE ATMOSPHERE Final Report, 1 Sep. 1976 - 30 Sep. 1977
James N. Bass, Krishin H. Bhravnani, Ben-Zion J. Guz, Robert R. Hayes, Shu T. Lai, Richard Pavelle, David C. Schwank, Donna L. Spiegelman, and Leo A. Whelan Hansom AFB, Mass. AFGL 30 Nov. 1977 170 p refs
(Contract F19628-76-C-0304)
(AD-A051126; AFGL-TR-77-0265) Avail: NTIS HC A08/MF A01 CSCL 04/1

This report describes significant analyses and computer programming problems performed in support of Air Force Geophysics Laboratory scientists. Mathematical and logical procedures are discussed; reference material and samples of results are presented. Various AFGL rapid orbit generation programs have been modified for satellite observation by aircraft, for prediction of longitude drift due to resonances, and for improved estimation of solar eclipsing. Geopotential model studies were conducted to identify significant terms and evaluate results in operational orbit determination programs. Ionospheric research programs include data reduction and analyses for plasma motion and electric field mapping, topside plasma monitoring on a Univac 1110, and scintillations modeling for equatorial and high latitude station coverage. A geographic-geomagnetic background continental outline plot program is also described. Analysis and data processing for the Multi-Spectral Measurement Program includes calibrations and initial flight data base design. A general data compaction routine for use with large data bases is described. A revised astronomical ephemeris program which uses the new JPL planetary system was developed. Author (GRA)

N78-23658# Geo-Atmospherics Corp. Lincoln, Mass.
ERROR ANALYSIS OF OPERATIONAL SATELLITE SOUNDINGS OF VERTICAL TEMPERATURE PROFILES Final Report, 12 Jan. - 30 Sep. 1977
Wayne D. Mount, B. Richard Fow, Donald E. Gustafson (Scientific Systems, Inc.), and William Ledsham Hanscom AFB, Mass. AFGL 31 Dec. 1977 185 p refs
(Contract F19628-77-C-0118; AF Proj. 7670)
(AD-A051125; GAC-78-CR-001; AFGL-TR-77-0248) Avail: NTIS HC A09/MF A01 CSCL 04/2

Satellite observations have the ability to determine meteorological conditions over inaccessible or unfriendly territory. The Defense Meteorological Satellite Program (DMSP) has two satellites (Bird 8531 and 9532) that provide infrared radiance data on a routine basis for operational applications at the Air Force Global Weather Center (AFGWC). Multi-spectral infrared radiometers operating at identical wavelengths on each of the satellites are used to interrogate different depths in the atmosphere to derive air temperature profile information. AFGWC has a sophisticated computer program that operates upon satellite radiance observations using their 12 hour forecast temperature fields as a first guess to derive a measure of the temperature profile. Errors are especially noticeable in the lower troposphere near the earth's surface and in the tropopause region. This report describes an analytical and a statistical approach to isolate the largest error sources and to suggest promising avenues for operation improvement. GRA

N78-23659# Lowell Univ. Research Foundation, Mass. Center for Atmospheric Research.
DIGITAL IONOSPHERIC SOUNDING IN THE ARCTIC Final Report, 1 Jul. 1975 - 30 Apr. 1977
Klaus Bibl, Bodo W. Reinisch, and Sheryl Smith Jul. 1977 105 p
(Contract F19628-76-C-0012; AF Proj. 7663)
(AD-A051428; ULRF-387/CAR; AFGL-TR-77-0152) Avail: NTIS HC A06/MF A01 CSCL 04/1

Digital techniques applied to ionospheric sounding measure new parameters of the reflected radio signals, like Doppler shift, wave polarization, and incidence angles. The Digisonde on-board AFGL's Airborne Ionospheric Observatory was modified to incorporate a discrete Fourier transform for each frequency-range bin. Goose Bay vertical ionograms were scaled in terms of 23 parameters. The monthly median curves of the most important ionospheric parameters for the period March 1975 to February 1976 are presented in the report. GRA

N78-23660# Utah State Univ., Logan. Space Science Lab.
ANALYSIS OF THE FARADAY ROTATION DIFFERENTIAL ABSORPTION TECHNIQUE FOR D-REGION MEASUREMENTS
K. D. Baker, R. D. Harris, R. A. McCue, and C. D. Westlund Hanscom AFB, Mass. AFGL Aug. 1977 94 p refs

(Contract F19628-74-C-0130)
(AD-A051134; AFGL-TR-77-0184; SR-4) Avail: NTIS HC A05/MF A01 CSCL 20/14

This report describes the optimization of a radio propagation experiment suitable for studies of the ionosphere D-region utilizing relatively low power, portable ground-based transmitters and simple receivers aboard small sounding rockets. A wave propagation model has been developed that numerically calculates the radio signal that would be received by a dipole antenna aboard a rocket traveling up through the ionospheric D-region. The Faraday rotation and differential absorption experienced by the wave can be used to deduce both electron concentrations and electron-neutral collision rates in the D-region. Faraday rotation and differential absorption were numerically calculated for a number of radio frequencies for three types of extreme conditions such as occur at high magnetic latitudes. Altitude profiles of these quantities provide information to base a selection of 2 or 3 frequencies that will yield maximum information on electron density and collision rate, based on the expected ionospheric conditions. Signal limitations such as atmospheric noise, telemetry error and transmission power were also used to interpret the Faraday rotation and differential absorption curves in order to achieve maximum accuracy. GRA

N78-23661# Wentworth Inst., Boston, Mass.
ATMOSPHERIC COMPOSITION INSTRUMENTATION Final Report, 1 Sep. 1973 - 30 Sep. 1977
John M. Otis Hanscom AFB, Mass. AFGL 26 Dec. 1977 33 p
(Contract F19628-74-C-0014; AF Proj. 6687)
(AD-A051455; AFGL-TR-78-0012) Avail: NTIS HC A03/MF A01 CSCL 04/1

This report summarizes the services supplied in support of the mechanical instrumentation for the LKD section of the Aeronomy Laboratory for the Air Force Geophysics Laboratory. Author (GRA)

N78-23662# Utah State Univ., Logan. Electro-Dynamics Lab.
AIRCRAFT BORNE MEASUREMENTS OF INFRARED ENHANCEMENTS DURING ICECAP 1975 AND 1976
Ronald J. Huppi and J. W. Reed (AFGL) Hanscom AFB, Mass. AFGL 28 Sep. 1977 131 p refs
(Contract F19628-74-C-0190)
(AD-A051454; EDL-SRL-77-2; AFGL-TR-77-0232; DNA-HAES-68; Scientific-3) Avail: NTIS HC A07/MF A01 CSCL 04/1

Significant infrared emission enhancements in the 2.75-3.04 micrometer region have been measured from the NKC-135A aircraft while viewing an aurorally excited atmosphere with a radiometer. The measured enhancements occurred while viewing all types of auroral forms, and they became significant with respect to the night sky background emissions whenever the N2(+) emissions at 3914A exceeded about 20 kiloRayleighs. Within the angular resolution capabilities of the instrumentation, the measured 2.8 micrometers enhancements appeared to co-vary spatially and temporally with enhancements in the ionization-prompt fluorescence of the N2(+). The enhancements did not correlate with emissions of the (5,3) band of the hydroxyl (OH) DeltaV=2 sequence at 1.7 micrometers. It appears that the most probable source creating the enhancements is the first overtone of nitric oxide (NO). Using the measured 2.8 micrometers and 3914A data and a synthetic NO model, the percentage of the total auroral electron energy which is radiated as first overtone NO photons was calculated for seven enhancement periods. The calculated percentage, photo-energy efficiencies, ranged from .4% to 1.0%. GRA

N78-23663# Fraunhofer-Gesellschaft, Garmisch-Partenkirchen (West Germany). Inst. fuer Atmosphaerische Umweltforschung.
ANALYSIS OF AEROSOL TRANSPORT AEROSOL REMOTE SENSING BY LIDAR Final Technical Report, Jan. - Sep. 1977
Reinhold Reiter, Walter Carnuth, Michael Littfass, and Horst Jaeger Sep. 1977 96 p refs
(Grant DA-ERO-75-G-077)
(AD-A051245) Avail: NTIS HC A05/MF A01 CSCL 04/1

Final report concerns primarily techniques and instrumentation adaptation (incl. calibration) and trial as these relate to analysis of aerosol transport and aerosol remote sensing by Lidar. The investigator concludes that the techniques and instruments which he has investigated operated successfully. Author (GRA)

N78-23664# Naval Civil Engineering Lab., Port Hueneme, Calif.
ICE ENGINEERING: STUDY OF RELATED PROPERTIES OF FLOATING SEA-ICE SHEETS AND SUMMARY OF ELASTIC AND VISCOELASTIC ANALYSES Interim Report, 1964 - 1976
K. D. Vaudrey Dec. 1977 85 p refs
(YF52555001)
(AD-A051184; CEL-TR-860) Avail: NTIS HC A05/MF A01 CSCL 08/12

This report summarizes approximately 12 yr of research effort by the Civil Engineering Laboratory (CEL) for developing engineering data and analytical capability for calculating operational bearing capacity of sea-ice sheets. The objectives of the report are: (1) to summarize the CEL elastic and viscoelastic experimental programs; (2) to review the two CEL-developed finite-element techniques for analyzing the structural behavior of the material; and (3) to present bearing capacity limits for both short- and long-term ice-sheet operations. At the outset of this research program little engineering data and only limited analytical techniques were available to assist the practitioner in evaluating ice-sheet bearing strength. Though much still remains to be learned, it is now possible to make qualitative engineering predictions on bearing strength as a result of the comprehensive laboratory and field research program directed at defining the tensile strength, compressive strength, flexural strength, elastic modulus, creep behavior, and their relationship to temperature and salinity. Bearing strength analysis, using the CEL-developed finite-element computer codes, can now be based on the material properties corresponding to the actual temperature and salinity gradient existing across the vertical profile of the ice plate. Author (GRA)

N78-23665# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
A QUANTITATIVE MODEL OF IONOSPHERIC ELECTRON DENSITY Final Report, Feb. 1975 - Feb. 1978
Willard P. Olson and Karl A. Pfitzer 28 Feb. 1978 47 p refs
(Contract N00014-75-C-0821)
(AD-A051335; MDC-G7433) Avail: NTIS HC A03/MF A01 CSCL 04/1

This report summarizes work performed during the entire contract period. The general goal was to develop a quantitative global ionospheric electron density model that can be used to predict variations in the electron density. The model developed under this contract represents the electron density at all latitudes and local times, it is computationally fast and can be used in a predictive mode. The electron density model relies on physical input parameters that can be measured directly (intensity of bands of the solar electromagnetic spectrum and the density of the solar wind). The model features include structure of the E, F1, and F2 layers, the day-night changes, the equatorial and seasonal anomalies and dependences on several forms of solar variability. Author (GRA)

N78-23666# North Carolina Univ., Chapel Hill. Dept. of Geology.
TECTONIC ATLAS OF URANIUM POTENTIAL IN CRYSTALLINE ROCKS OF THE EASTERN US
Jeffrey K. Greenberg, Stephen A. Hauck, Paul C. Ragland, and John J. W. Rogers Jun. 1977 98 p refs
(Contract EY-76-C-13-1661)
(GJBX-69(77)) Avail: NTIS HC A05/MF A01

The atlas format includes all areas of uranium exploration potential shown by state. Tectonic divisions are shown and explained on the tectonic index map. Each entry (locality) on the state maps has a number referring to its place on the descriptive tables. Each tabulated entry includes the locality name, county(ies), latitude and longitude, tectonic affinity, exploration potential, ore host rock, ore type, alteration, important mineralogy, age, trace element data, and a key to pertinent references listed at the end of the section. Cross reference listing of localities by exploration potential and by tectonic affinity are also included.

A listing of aeroradiation survey references used in evaluating the Eastern U.S. is included. ERA

N78-23667# Academy of Sciences (USSR), Moscow. Space Research Inst.

EXPERIMENTAL EVIDENCE OF THE EXISTENCE OF OPENED AND CLOSED MAGNETOSPHERES, PART 2

E. M. Dubinin, I. M. Podgorny, and Y. N. Potanin 1977 26 p refs

(PR-355) Avail: NTIS HC A03/MF A01

The flow of collisionless plasma around a magnetic dipole was experimentally studied for high Alfven's Mach numbers (approx. 10). The principle of limited simulation was used to choose plasma parameters. The configurations of an artificial magnetosphere's fields in the noon-midnight meridian plane were obtained with a system of magnetic probes. For the southern field component a magnetic curl (visor) appears in the flow on the dayside magnetosphere, and the field lines belonging to the plasma flow. For the northern component, dayside field configurations differ only slightly for low and high Alfven's Mach numbers. The data considered indicate that the structures observed in laboratory experiments are present in space. ESA

N78-23668# Royal Netherlands Meteorological Inst., De Bilt.

COMPUTER PROGRAM FOR CALCULATION OF THE INCIDENT RADIATION PER DAY ON A HORIZONTAL SURFACE AT THE EDGE OF THE ATMOSPHERE [EEN COMPUTERPROGRAMMA VOOR HET BEREKENEN VAN DE INKOMENDE STRALING AAN DE RAND VAN DE ATMOSFEER PER DAG DOOR EEN HORIZONTAAL OPPERVLAK]

H. A. R. DeBruin Apr. 1977 21 p refs In DUTCH

(KNMI-V-294) Avail: NTIS HC A02/MF A01

A program is described for the calculation of the incident solar radiation per day on a horizontal surface at the edge of the atmosphere as a function of the location on earth (latitude) and the day number. By-products of this program are declination and sun length, as well as day length and the distance earth-sun as function of latitude and day number for an average year. The program was written for meteorological applications. ESA

N78-23669# Research Inst. of National Defence, Stockholm (Sweden).

TRITIUM IN ATMOSPHERIC HYDROGEN GAS AT A SWEDISH SAMPLING STATION AT HAGFORS

Brita Bernstroem Sep. 1977 18 p refs

(FOA-C-40062-T2) Avail: NTIS HC A02/MF A01

A sampling system that collects normal air and combusts the hydrogen catalytically to water is described. Measurements of HT from November 1975 to the end of 1976 are reported. An average tritium level of about 60 T atoms/mg air is found at Hagfors. Two peaks were registered during this period, one in November 1975 (approx. 155 T atoms/mg air) and one in March 1976 (approx. 580 T atoms/mg air). The origin of the peaks is discussed. Author (ESA)

N78-23670# Uppsala Ionospheric Observatory (Sweden).

SKY BACKGROUND MEASUREMENTS ON THE WAVELENGTH REGION FROM 4800 A TO 5800 A AT THE LATITUDE OF THE POLAR CLEFT

Kjell Henriksen, Bengt Holback, and Georg Witt [1977] 13 p refs Prepared jointly with Auroral Obs. Tromso and Stockholm Univ.

Avail: NTIS HC A02/MF A01

At Ny-Aalesund the auroral emissions within the polar cleft can be measured continuously midwinter, but the intensity of the Rayleigh scattered sunlight is approximately as high as the average intensity of the auroral emissions when the solar depression angle is less than 10 deg. When the geometric shadow height approaches 100 km, most of the Rayleigh scattered light observed on the ground is due to multiple scattering through the lower atmosphere. Simultaneous photometer and spectrometer observations were used to estimate the background intensity, and intervals when Ny-Aalesund is within the polar cleft, are obtained. Author (ESA)

N78-23671# Uppsala Ionospheric Observatory (Sweden).

SKYWAVE BACKSCATTER STUDIES OF TEMPERATE LATITUDE Es

L. B. Kolawole and H. Derblom Sep. 1977 20 p refs Submitted for publication Sponsored partly by Swed. Intern. Develop. Authority

(UIO-SR-77-04) Avail: NTIS HC A02/MF A01

A swept-azimuth skywave backscatter sounder was used to study the temperate latitude Es at Uppsala for a period of seven years (1969-1975). The investigation pertains to the temporal and geographical characteristics of Es occurrence, the duration and movement of Es patches. Both the diurnal and seasonal variations of Es occurrence show significant asymmetry. Es activity at this station is more of a nighttime than a daytime phenomenon except in summer when the occurrence rate is approximately the same throughout the day. Patches with duration ranging from a few minutes to several hours are observed. The amount of Es activity observed over water is much more than is observed over the land surface. The dominant wind component in the E-region at Uppsala is the westward zonal wind superimposed with a semidiurnal component of a tidal wave in the same direction, the wave being strongest in the night. Author (ESA)

N78-23672# Geological Survey, Menlo Park, Calif.

PRINCIPAL FACTS, ACCURACIES, SOURCES, BASE STATION DESCRIPTIONS, AND PLOTS FOR 2227 GRAVITY STATIONS ON THE CHICO 1 DEGREE BY 2 DEGREE QUADRANGLE, CALIFORNIA Final Report

S. L. Robbins, H. W. Oliver, R. F. Sikora, W. L. Rambo, and C. W. Roberts 1977 106 p refs

(PB-276770/5; USGS/GD-78/006) Avail: NTIS HC A06/MF A01 CSCL 08E

Principal facts for 2227 gravity stations on the Chico 1 degree x 2 degrees quadrangle, California are given in 19 separate tables. Descriptions, sketch maps, and pictures of 15 base stations as well as location plots by station numbers of all 2227 stations at a scale of 1:250,000 were included. All of the gravity stations were reduced to complete Bouguer anomalies with terrain and curvature corrections made to 166.7 km. A discussion of individual data was provided and includes information pertaining to data sources, gravity meters used, base stations used, reduction problems, and overall accuracies of the data. GRA

N78-23673# University of Southern Calif., Los Angeles. Dept. of Civil Engineering.

METHODS FOR PREDICTION OF STRONG EARTHQUAKE GROUND MOTION, VOLUME 1 Final Technical Report, 1 Oct. 1976 - 30 Sep. 1977

M. D. Trifunac Jan. 1978 258 p refs

(Contract AT(49-24)-0364)

(PB-277831/4; NUREG-0406-Vol-1) Avail: NTIS HC A12/MF A01 CSCL 08K

The results of the work on characterization of strong earthquake ground motion are summarized. One application is for use in licensing and evaluation of operating nuclear power plants. Statistical analysis of strong motion accelerograms led to an equation in which Fourier spectral amplitudes of the accelerograms are functions of earthquake magnitude, epicentral distance, recording site conditions, and component direction. A similar equation was developed in which earthquake magnitude and epicentral distance were replaced with intensity. Empirical models from these equations can be used to estimate spectral shapes. Author

N78-23674 Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).

THE RECONNAISSANCE GRAVITY SURVEY OF AUSTRALIA: QUALITATIVE ANALYSIS

A. R. Fraser, F. Darby, and K. R. Vale 1977 103 p refs

(BMR-198; BMR-MF15; ISBN-0-642-03101-0; Cat-77-2986-X; R77/180) Avail: Issuing Activity

As a first step towards analysing Australia's gravity pattern and its correlation with the regional structure, the Bouguer anomaly field over Australia and its northwest continental shelf was divided into 96 regional gravity provinces. A gravity province is a region where the gravity field is characterised by uniformity of at least one property, such as contour trend, gravity level, or degree of contour disturbance, which distinguishes it from a neighbouring province. Many gravity provinces are subdivided into gravity units, which are similar to provinces in definition, but of smaller size.

The provinces and units are discussed in relation to known geology and geophysics. In general, provinces of high Bouguer anomaly correspond to Proterozoic or early Palaeozoic metamorphic belts, provinces of low Bouguer anomaly to granitic batholiths or Phanerozoic sedimentary basins, and provinces of complex contour pattern to Precambrian or Palaeozoic orogenic domains. Author

N78-23675# University of Southern Calif., Los Angeles. Dept. of Civil Engineering.
METHODS FOR PREDICTION OF STRONG EARTHQUAKE GROUND MOTION, VOLUME 2 Final Technical Report, 1 Oct. 1976 - 30 Sep. 1977
M. D. Trifunac Jan. 1978 268 p refs
(Contract AT(49-24)-0364)
(PB-277832/2; NUREG-0406-Vol-2) Avail: NTIS HC A12/MF A01 CSCL 08K

A note on an instrumental comparison of the Modified Mercalli (MMI) and the Japanese Meteorological Agency (JMA) intensity scales is presented. Uniform risk functionals which describe strong earthquake ground motion were included. Numerical estimation, and an application to the Fourier amplitude of acceleration were examined. Dependence of the duration of strong earthquake ground motion on magnitude, epicentral distance, geologic conditions at the recording station, and frequency of motion was discussed. Correlations of frequency dependent duration of strong earthquake ground motion with the modified Mercalli intensity and the geologic conditions at the recording stations were also studied. GRA

N78-24040# Joint Publications Research Service, Arlington, Va.
COSMONAUTS STUDY THE EARTH
G. A. Ivanyan and K. Ya. Kondratyev *In its* Transl. on USSR Sci. and Technol. (JPRS-71181) 25 May 1978 p 59-68 Transl. into ENGLISH from Priroda (Moscow), no. 12, 1977 p 48-55 (For availability see N78-24033 14-99)
Copyright. Avail: Issuing Activity

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N78-23676 Arizona State Univ., Tempe.
A TWO-DIMENSIONAL SURFACE WIND DISTRIBUTION OVER RUGGED TERRAIN Ph.D. Thesis
David Da-Pan Chen 1977 82 p
Avail: Univ. Microfilms Order No. 78-05383

Local wind observations indicate a strong slope wind trend in the greater Phoenix area. The wind is upslope during the sunshine hours and is downslope during the non-sunshine hours of a day. Well developed drainage wind flows along the rivers in the early evenings. These features of the wind in the surface layer were closely simulated by applying classical slope wind theory over the terrain surface with slope variation. In a 2-D surface wind model, air was treated as compressible and the equations of motion were derived on the balance between the pressure gradient force and the frictional force. Surface wind distributions were generated with the model for 24 hours on a winter day. Dissert. Abstr.

N78-23677 Michigan Univ., Ann Arbor.
A NUMERICAL STUDY OF CLEAR-SKY NOCTURNAL FOG Ph.D. Thesis
Robert Charles Kessler 1977 124 p
Avail: Univ. Microfilms Order No. 7804736

A numerical model was developed which predicted the onset and development of fog on clear nights. Physical processes modelled included turbulent exchange, long wave radiation, water phase change, and droplet settling. The model consisted of prognostic equations for potential temperature, specific humidity, liquid water concentration, and soil temperature, along with a surface heat balance equation. The equations were solved numerically on a vertical grid. Upper and lower boundary conditions were formulated. The procedure for model initialization is described. Dissert. Abstr.

N78-23678# Committee on Commerce, Science, and Transportation (U. S. Senate).
NATIONAL CLIMATE PROGRAM ACT
Washington GPO 1977 503 p refs Hearings on S. 421 and S. 1652 before Subcomm. on Sci., Technol., and Space of the Comm. on Commerce, Sci., and Transportation, 95th Congr., 1st Sess., 8-10 Jun., 5-6 and 8 Jul. 1977
(GPO-94-382) Avail: Subcomm. on Sci., Technol., and Space

The economy, food production, water and energy supplies, the human condition, are dependent on climate. Data about future climate patters does not exist and human activity on climate is another uncertainty. Given such uncertainties the subcommittee held hearings on climate, including the proposal of a Bill to establish a national climate program. The subcommittee's exploration into this subject were two fold: (1) the uses of existing information about weather and climate; (2) what science can contribute to the understanding of climate patterns, to better predict their impacts, and the ability to respond to climate changes. G.Y.

N78-23679*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SIMULATION STUDIES OF WIDE AND MEDIUM FIELD OF VIEW EARTH RADIATION DATA ANALYSIS
Richard N. Green May 1978 46 p refs
(NASA-TP-1182; L-12003) Avail: NTIS HC A03/MF A01 CSCL 04B

A parameter estimation technique is presented to estimate the radiative flux distribution over the earth from radiometer measurements at satellite altitude. The technique analyzes measurements from a wide field of view (WFOV), horizon to horizon, nadir pointing sensor with a mathematical technique to derive the radiative flux estimates at the top of the atmosphere for resolution elements smaller than the sensor field of view. A computer simulation of the data analysis technique is presented for both earth-emitted and reflected radiation. Zonal resolutions are considered as well as the global integration of plane flux. An estimate of the equator-to-pole gradient is obtained from the zonal estimates. Sensitivity studies of the derived flux distribution to directional model errors are also presented. In addition to the WFOV results, medium field of view results are presented. Author

N78-23680# National Weather Service, Silver Spring, Md.
NO-MOVING PARTS ANEMOMETER DESIGN ANALYSIS PROGRAM
Anthony W. Cheek and Charles F. Lambert Oct. 1977 27 p
(PB-277524/5; NOAA-TM-NWS-EDL-16; NOAA-S/T-77-2924; NOAA-78010402) Avail: NTIS HC A03/MF A01 CSCL 04B

The search for a no moving parts anemometer that would be satisfactory for marine applications, remote locations, and where icing occurs was conducted. Wind tunnel, rain, solar radiation, and rime ice formation tests were made for equipment accuracy and survival. GRA

N78-23681# National Oceanic and Atmospheric Administration, Princeton, N. J. Geophysical Fluid Dynamics Lab.
GEOPHYSICAL FLUID DYNAMICS LABORATORY (GFDL) ACTIVITIES-FY77, PLANS-RY78
30 Sep. 1977 123 p refs
(PB-277788/6; NOAA-77123006) Avail: NTIS HC A06/MF A01 CSCL 04B

Included are specific recent achievements and future goals for the following major research categories: climate dynamics; middle atmosphere dynamics and chemistry, experiment prediction; ocean circulation; planetary circulations; observations studies; hurricane dynamics; mesoscale dynamics; convection and turbulence. GRA

N78-23682# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 12829C LANCE MISSILE NUMBER 2479, ROUND NUMBER 306 DST
Dec. 1977 40 p
(DA Proj. 1T6-65702-D-127)

(AD-A052149; ECOM-DR-955) Avail: NTIS HC A03/MF A01 CSCL 16/1

Meteorological data gathered for the launching of 12829C Lance, Missile Number 2479, Round Number 306 DST, are presented in tabular form. Author (GRA)

N78-23683# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

AN INVESTIGATION OF DUST STORM GENERATION IN THE SOUTHERN GREAT PLAINS M.S. Thesis

Marshall Conrad Pollard Dec. 1977 86 p refs

(AD-A052064; AFIT-CI-78-46) Avail: NTIS HC A05/MF A01 CSCL 04/2

An investigation of dust storms in the southern Great Plains was conducted to determine correlations between dust and precipitation, Antecedent Precipitation Index (API), wind, time of occurrence, and dew-point depression. Relationships between blowing dust and characteristics of the southern Great Plains, agricultural practices, location of source regions, transport mechanisms, and favorable synoptic situations also were considered. Data used in this study consisted of surface observations from 34 southern Great Plains weather stations during February through May for a 10-yr period (1966-1975). Results of the analyses showed an insignificant correlation of precipitation amounts prior to a dust storm. Also, dew-point depression was weakly correlated to dust generation. A negative correlation existed between API and the number of stations reporting dust. It was found that wind speed and direction were significantly correlated with occurrences of dust. The greatest frequency of occurrences of dust was between 1800 to 0100 GMT (12:00 to 7:00 PM CST). It was determined that the location of a source region was an important factor for generation of dust. Author (GRA)

N78-23684# Air Force Geophysics Lab., Hanscom AFB, Mass.

REAL TIME TORNADO WARNING UTILIZING DOPPLER VELOCITIES FROM A COLOR DISPLAY

Carlton L. Bjerkaas and Ralph J. Donaldson, Jr. 10 Mar. 1978 9 p refs Presented at Conf. on Radar Meteorology, 18th, Atlanta, 28-31 Mar. 1978

(AD-A051943; AFGL-TR-78-0060) Avail: NTIS HC A02/MF A01 CSCL 17/9

In April to June 1977, an operational test was conducted in Oklahoma utilizing Doppler radar as the basis for real-time warning of severe weather. The Air Force Geophysics Laboratory color display was mated to the 10 cm Cimarron Doppler radar and used as warning back-up capability to the operations center at Norman. Experiences in real-time identification of mesocyclone signatures which are characteristic of severe weather are discussed. A detailed analysis of parameters associated with one tornadic mesocyclone is presented. A comparison is made between parameter values determined from the color display and from fine resolution digitized data. Author (GRA)

N78-23685# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

FREEZING PRECIPITATION IN THE SOUTHEASTERN UNITED STATES M.S. Thesis - Texas A and M Univ.

William Robert Young May 1978 135 p refs

(AD-A052061; AITT-CI-78-24) Avail: NTIS HC A07/MF A01 CSCL 04/2

An investigation of various surface and upper-air parameters and their relationship to the occurrence of ice storms in the southeastern United States was conducted to determine as many relationships and ranges of values as possible. Four storms in the past 10 years were selected and studied in detail. Temperature, dew point, wind, visibility, and pressure were the surface parameters considered, while 850 mb temperature, 850 mb dew point, 700 mb temperature, 850 mb wind, 850 mb/700 mb averaged wind direction, and 1000-500 mb thickness were the upper-air parameters considered. Various combinations of parameters also were considered. Data consisted primarily of 215 soundings of winter weather types in or around ice storms from 1968-1977 for the months of December through early February. Results involved a decision checklist that utilizes surface temperature, surface dew point, 850 mb temperature, 1000-500 mb thickness, temperature/dew point spread and 850 mb/700 mb averaged wind direction. It was found that if the criteria in the decision checklist are met, then a most probable forecast of precipitation type can be obtained by using the derived decision graph involving surface temperature and 850 mb temperature. Author (GRA)

N78-23686# Army Electronics Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.

THE 12828D LANCE MISSILE NO. 3304, ROUND NO. 308 (19 JANUARY 1978) Meteorological Data Report

Jan. 1978 38 p

(DA Proj. 1T6-65702-D-127)

(AD-A052190; DR-960) Avail: NTIS HC A03/MF A01 CSCL 16/1

Meteorological data gathered for the launching of 12828D Lance, Missile Number 3304, Round Number 308 ESL, are presented in tabular form. Author (GRA)

N78-23687# Army Electronics Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.

THE 12830B LANCE MISSILE NO. 3331, ROUND NO. 307 ESL (12 JANUARY 1978) Meteorological Data Report

Jan. 1978 31 p

(DA Proj. 1T6-65702-D-127)

(AD-A052189; DR-959) Avail: NTIS HC A03/MF A01 CSCL 16/1

Meteorological data gathered for the launching of the 12830B Lance, Missile Number 3331, Round Number 307 ESL, are presented in tabular form. Author (GRA)

N78-23688# Army Electronics Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.

THE 19301A GSRS MISSILE NUMBER V-2, ROUND NUMBER V-2 (9 DECEMBER 1977) Meteorological Data Report

Dec. 1977 20 p

(DA Proj. 1T6-65702-D-127)

(AD-A052188; ECOM-DR-956) Avail: NTIS HC A02/MF A01 CSCL 16/1

Meteorological data gathered for the launching of 19301A GSRS, Missile No. V-2, Round No. V-2, are presented in tabular form. Author (GRA)

N78-23689# Air Force Geophysics Lab., Hanscom AFB, Mass.

INTERACTION OF A TURBULENT PLANAR HEATED JET WITH A COUNTERFLOWING WIND

Milton M. Klein 26 Sep. 1977 30 p refs

(AD-A051127; AFGL-TR-77-0214; AFGL-AFSG-375) Avail: NTIS HC A03/MF A01 CSCL 04/2

Experimental and theoretical programs are being conducted to aid in the development of an operational warm fog dispersal system using momentum-driven ground-based heat sources. In previous investigations, the wind was in the same direction as the jet (coflowing). The present investigation is concerned with a jet opposite in direction to the ambient wind (counterflowing or opposing jet). A model for calculating the dynamic characteristics of a cold counter-flowing jet has been extended to take account of the effect of heating upon the jet. The effect of buoyancy upon the motion of the jet will be presented in a subsequent report. GRA

N78-23690# Army Electronics Command, Fort Monmouth, N. J.

AN OPTICAL SYSTEM FOR PROFILING WIND AND REFRACTIVE-INDEX FLUCTUATION

G. R. Ochs, Ting-I. Wang, and E. J. Goldenstein Oct. 1977 17 p refs

(AD-A051434; ECOM-77-7) Avail: NTIS HC A02/MF A01 CSCL 04/2

An instrument is described that measures the crosswind and the refractive-index structure parameter (C sub n squared) at six locations along an optical path. Operating instructions, calibration procedures, and circuit diagrams are included. GRA

N78-23691# Air Force Geophysics Lab., Hanscom AFB, Mass.

HYDROMETEOR DATA AND ANALYTICAL-THEORETICAL INVESTIGATIONS PERTAINING TO THE SAMS RAIN EROSION PROGRAM OF THE 1972-1973 SEASONS AT WALLOPS ISLAND, VIRGINIA: AFGL/SAMS REPORT NUMBER 5

Vernon G. Plank 5 Jul. 1977 236 p
(AD-A051192; AFGL-TR-77-0149; AFGL-ERP-603) Avail: NTIS HC A11/MF A01 CSCL 04/2

Radar, aircraft, and surface measurement information is presented concerning the liquid-water-content values and size distribution properties of the hydrometeors that existed along the trajectory paths of the four SAMS missiles that were fired into Wallops storm during the 1972-73 season. GRA

N78-23692# Institut Royal Meteorologique de Belgique, Brussels.
WIND VELOCITY AND DIRECTION IN BELGIUM [LA VITESSE ET LA DIRECTION DU VENT EN BELGIQUE]
A. Bodeux 1977 171 p In FRENCH and DUTCH
(Misc-Ser-B-42) Avail: NTIS HC A08/MF A01

Synoptic observation from seven stations during the period 1963 to 1972 concerning wind velocity and direction were compiled. Tabular presentations are given for the following data: velocity at synoptic hours; distribution of velocities and directions; wind and atmospheric pressure; wind and cloud cover; and wind and air temperature. ESA

N78-23693# Stockholm Univ. (Sweden). Dept. of Meteorology.
INCORPORATION OF PLANETARY BOUNDARY LAYER PROCESSES INTO NUMERICAL FORECASTING MODELS
Mohamed S. Smeda Oct. 1977 47 p refs Sponsored in part by Libyan Min. of Educ., Libyan Min. of Commun., and Libyan Meteorolog. Dept.
(DM-23) Avail: NTIS HC A03/MF A01

A study was made of the evolution of the Planetary Boundary Layer Height (PBLH), the heat flux, and momentum flux using Clarke's Wangara data for a period of two days and two nights, 33/34-34/35. The observed Wangara data are considered as being an output of the first two integral levels of a general circulation model, at 1000 and 2000 meters height. A time dependent equation was used to forecast, explicitly, the PBLH for both convectively unstable and stable peiods. A comparison is made between the observed and the computed values whenever possible. In the unstable case, the Deardorff model was used for the prediction of the unstable PBLH. Part of the stable case study involved a formulation of a time dependent model for the prediction of the stable PBLH. The solution obtained from the model compared favourably with the results of a model suggested by Khakimov. Author (ESA)

N78-23694# International Institute for Applied Systems Analysis, Laxenburg (Austria).
CAN WE PREDICT CLIMATE FLUCTUATIONS?
Jill Williams Aug. 1977 28 p refs Presented at the Univ. Corp. for Atmospheric Res. and Aspen Inst. for Humanistic Studies Seminar on 'The Winter of 1977: Was it Really Unusual?' 8-9 Jun. 1977
(IIASA-PP-77-7) Avail: NTIS HC A03/MF A01

Causes of potentially predictable climatic variability are outlined - these include changes in both the external and internal climate system. The advantages and disadvantages of three methods of forecasting the variability are discussed with emphasis on the use of numerical models of atmospheric circulation. ESA

N78-23695 National Technical Information Service, Springfield, Va.
ICE AND FOG: DETECTION AND WARNING SYSTEMS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Feb. 1978
Guy E. Habercom, Jr. Mar. 1978 155 p Supersedes NTIS/PS-77/0188; NTIS/PS-76/0096; NTIS/PS-75/231
(NTIS/PS-78/0181/4; NTIS/PS-77/0188; NTIS/PS-76/0096; NTIS/PS-75/231) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 04B

Sea ice, aircraft ice, bridge ice, and fog formation detecting methods are reviewed in government-sponsored research reports. Remote aerial sensing and ground based detection systems are among the methods investigated. (This updated bibliography contains 150 abstracts, 32 of which are new entries to the previous edition.) GRA

N78-23696# National Oceanic and Atmospheric Administration, Boulder, Colo. Weather Modification Office.
THE POTENTIAL OF HURRICANE MODIFICATION FOR CAUSING A SYSTEMATIC PREDICTABLE CHANGE OF A HURRICANE TRACK AS A RESULT OF THE ROSSBY ACCELERATION
Robert W. Jones (National Hurricane and Experimental Meteorological Lab., Coral Gables, Fla.) Dec. 1977 23 p refs
(PB-278148/2; NOAA-TM-ERL-WMPO-42) Avail: NTIS HC A02/MF A01 CSCL 04B

Results are given for two numerical experiments with a model tropical cyclone that was integrated with a variable Coriolis parameter. No evidence was found that a man made modification of a hurricane would lead to a systematic and predictable change of the track due to the Rossby acceleration. This conclusion was based upon calculations of the Rossby accelerations, taken from the mature stage, which did not agree with corresponding changes of the track. Both a vortex that was modified by enhanced heating and an unmodified vortex were examined. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N78-23697 Wisconsin Univ., Madison.
NONLINEAR DYNAMICS OF LONG STANDING WAVES Ph.D. Thesis
See Whan Kang 1977 145 p
Avail: Univ. Microfilms Order No. 7800027

The phenomenon of nonlinear resonant interactions in long standing waves was studied experimentally and theoretically. In order to get uniformly valid solutions for a long time, a non-linear resonant interaction theory was developed using the asymptotic method of multiple time scales. In order to provide experimental evidence related to the proposed thoery, a series of experimental measurements was made in a laboratory sized rectangular tank, filled with ordinary tap water at room temperature to various shallow water depths. Waves were generated by a piston-type wavemaker. Through harmonic analysis, amplitudes and phase angles of the first two harmonics were isolated and analyzed as functions of time. The measurements provide good experimental evidence for the theoretical results. Dissert. Abstr.

N78-23698 Michigan Univ., Ann Arbor.
A TECTONIC-BASED RAYLEIGH WAVEGROUP VELOCITY MODEL FOR PREDICTION OF DISPERSION CHARACTER THROUGH OCEAN BASINS Ph.D. Thesis
Frederick John Mauk 1977 260 p
Avail: Univ. Microfilms Order No. 78-04766

Rayleigh group velocities specific to each of the twelve continental and one oceanic geological division were compiled from the literature. Rayleigh velocities for the seven remaining oceanic divisions were determined by partitioning empirically derived functional relationships between sea floor age and Rayleigh group velocities. Dispersion analyses for seventeen random paths through the Pacific Ocean, four for the Indian Ocean and six for the Atlantic Oceans were compared with model predicted dispersion curves. Observed minus predicted velocity residuals for the Pacific are significantly less than the uncertainty limits. Systematic positive residuals occur in the other three major ocean basins, however. The failures of the Pacific based model to predict dispersion accurately in these other basins suggests that there may be fundamental structural differences among the world's ocean basins. Dissert. Abstr.

N78-23699 Florida Univ., Gainesville.
FLOW SEPARATION AND RELATED PHENOMENA AT TIDAL INLETS Ph.D. Thesis
Emin Ozsoy 1977 346 p
Avail: Univ. Microfilms Order No. 78-06740

Flow and mass transport were analyzed for turbulent jets issuing from tidal inlets during the ebbing phase. Frictional resistance and topographical variations of the bottom and ambient cross currents were taken into account. In studying mass transport, settling of materials to the bottom and ambient concentrations

were also allowed. An experimental approach was used in determining the wave scattering by narrow openings such as tidal inlets, tsunami breakwaters, and harbor entrances. Flow separation and generation of jets and vortices in the near field of the opening determines the subsequent loss of energy and the scattering of waves in the far field. Approximate methods were used in analyzing the nonlinear behavior of a narrow opening in the presence of flow separation. Experimental results were interpreted by making use of these approximate solutions.
Dissert. Abstr.

N78-23700*# Florida Univ., Gainesville. Coastal and Oceanographic Engineering Lab.
SATELLITE APPLICATIONS TO A COASTAL INLET STUDY, CLEARWATER BEACH, FLORIDA
Y. H. Wang, M. Smutz, B. E. Ruth, and H. K. Brooks Dec. 1977 25 p refs
(Grant NsG-7236)
(NASA-CR-156994; UFL/COEL-77/026) Avail: NTIS HC A02/MF A01 CSCL 08C

Two sets of LANDSAT magnetic tapes were obtained and displayed on the screen of an IMAGE 100 computer. Spectral analysis was performed to produce various signatures, their extent and location. Subsequent ground truth observations and measurements were gathered by means of hydrographic surveys and low-altitude aerial photography for interpretation and calibration of the LANDSAT data. Finally, a coastal engineering assessment based on the LANDSAT data was made. Recommendations to the City of Clearwater regarding the navigational channel alignment and dredging practice are presented in the light of the inlet stability. Author

N78-23701# Woods Hole Oceanographic Institution, Mass.
AN ACOUSTIC SENSOR OF VELOCITY FOR BENTHIC BOUNDARY LAYER STUDIES
Albert J. Williams and John S. Tochko Apr. 1978 20 p refs Reprinted from the Proc. of the 8th Intern. Colloq. on Ocean Hydrodynamics.
(Contract N00014-74-C-0262; NR Proj. 083-004)
(AD-A052066; WHOI-78-4; WHOI-CONTRIB-3843) Avail: NTIS HC A02/MF A01 CSCL 08/3

The techniques of flow measurement which have been successful in laboratory studies of boundary layer turbulence are difficult to use in the ocean; and the current meters generally used in the ocean are not suited to measuring bottom boundary layer flow. A suitable sensor for bottom turbulence measurements should measure vector components, respond linearly to these components, maintain an accurate zero point, disturb the flow negligibly or in a well predicted way, and sense a small enough volume to represent the important scales of the flow. We have constructed an acoustic travel time sensor in a configuration that will allow vector components of the flow to be measured with sufficient accuracy to compute Reynolds stress at a point 50 cm above the bottom. This sensor responds linearly to horizontal and vertical flows in flume tests. When the flow is neither horizontal nor vertical, the wake from one acoustic transducer may interfere with the measurement along one sensing path but there is sufficient redundancy in the determination to reject this path and still resolve the vector velocity. An instrument using four of these sensors is being designed to measure Reynolds stress in the lower six meters of the ocean. Author (GRA)

N78-23702# Woods Hole Oceanographic Institution, Mass.
WHOI/BROWN CONDUCTIVITY, TEMPERATURE, AND DEPTH MICROPROFILER
N. L. Brown and G. K. Morrison Feb. 1978 272 p refs
(Contract N00014-66-C-0241)
(AD-A052054; WHOI-78-23) Avail: NTIS HC A12/MF A01 CSCL 08/10

A Conductivity, Temperature and Depth (CTD) profiler has been designed to make precise fine scale measurements of these physical parameters in the ocean. This CTD system consists of a shipboard Data Terminal deck unit and an underwater unit which provides continuous sampling of the three variables as it is lowered into the water. Additional sensors can be added to measure other variables; the most common is dissolved oxygen. This report is a detailed description of the CDT System and includes the necessary documentation to operate and maintain the equipment. Author (GRA)

N78-23703# Woods Hole Oceanographic Institution, Mass.
NOTES ON THE 1977 SUMMER STUDY PROGRAM IN GEOPHYSICAL FLUID DYNAMICS AT THE WOODS HOLE OCEANOGRAPHIC INSTITUTION
George Veronis and Mary Thayer, ed. Dec. 1977 267 p refs
(Contract N00014-77-C-046623)
(AD-A051625; WHOI-77-64) Avail: NTIS HC A12/MF A01 CSCL 20/4

Lectures recorded in the first part of this report served as the introduction to the study of turbulence which was the principal theme of the nineteenth summer program in Geophysical Fluid Dynamics at the Woods Hole Oceanographic Institution. The abstracts of the seminars by invited speakers cover a broad range of topics, from astrophysics to experimental, laboratory fluid dynamics. The seminars served to introduce the student fellows to the tremendous diversity of studies that fall within the scope of geophysical fluid dynamics. Included among the abstracts are the seminars presented during the one-week symposium on geostrophic turbulence. GRA

N78-23704# Washington Univ., Seattle. Dept. of Oceanography.
CHEMICAL AND GEOCHEMICAL STUDIES OFF THE COAST OF WASHINGTON Progress Report, Sep. 1976 - Aug. 1977
Roy Carpenter, comp. 1977 39 p refs
(Contract EY-76-S-06-2225-024)
(RLO/2225/t24-20; A76-54) Avail: NTIS HC A03/MF A01

The aim is to provide basic data required to characterize underlying chemical and physical processes and their rates which control the distributions, concentrations and ultimate fate of some of the potentially hazardous agents associated with fossil fuel and/or nuclear power production or transportation. The investigation dealt with: (1) studies of the uptake and transfer of Po-210, Pb-210 and related elements in the well defined surf zone ecosystem at Copalis Beach, Wa; (2) field studies of the uptake and transport by zooplankton fecal pellets of Po-210, Pb-210 and other trace inorganic and organic constituents in a well studied part of Puget Sound; Po-210, Pb-210, studies of the behavior of Po-210 and Pb-210 in sediments off the coast of Washington and the application of the Pb-210 determinations in sediment cores to determine sediment accumulation rates for the past 100 years, the depth of the surface mixed layer, and a mixing coefficient for the surface sediments; and investigations of aliphatic and aromatic hydrocarbons in samples of organisms and sediment cores. ERA

N78-23705# Royal Netherlands Meteorological Inst., De Bilt.
INSTRUMENTATION FOR OCEANIC MIXING LAYER INVESTIGATION [INSTRUMENTATIE VOOR HET OCEANISCH MENGLAAGONDERZOEK]
G. J. Prangsma 1977 31 p refs In DUTCH
(KNMI-V-291) Avail: NTIS HC A03/MF A01

The combination of conductivity-temperature-depth meter to be used onboard a floating ship and an expandable bathythermograph for spatial measurements is discussed as instrumentation for the investigation of the oceanic mixing layer. Topics dealt with include requirements of the components of the instrumentation, data recording, and calibration procedures. The experience obtained so far is presented. ESA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N78-23706*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN INDUCTIVELY POWERED TELEMETRY SYSTEM FOR TEMPERATURE, EKG, AND ACTIVITY MONITORING
Thomas B. Fryer, Gordon F. Lund (San Jose State Univ., Calif.), and Bill A. Williams (San Jose State Univ., Calif.) May 1978 43 p refs
(Grant NsG-2293)

(NASA-TM-78486; A-7423) Avail: NTIS HC A03/MF A01 CSCL 06B

An implant telemetry system for the simultaneous monitoring of temperature, activity, and EKG from small animals, such as rats, was designed with the feature that instead of a battery the system is energized by an inductive field. A 250 kHz resonant coil surrounds the cage (30 x 30 x 20 cm) and provides the approximately 100 microns of power required to operate the implant transmitter while allowing the animal unrestrained movement in the cage. The implant can also be battery operated if desired. RF transmission is in the 8-10 MHz band, which allows the use of a simple, essentially single IC chip, receiver.
Author

N78-23707# Institut Franco-Allemand de Recherches, St. Louis (France).

PRESSURE MEASUREMENTS IN THE COCHLEA OF A GUINEA PIG [MESURES DE PRESSION DANS LA COCHLEE DU COBAYE]

A. Dancer 9 May 1977 13 p In FRENCH Presented at 2d Symp. of the Min. for Cult. and Environ. on Noise Effects, San Bastiano, Corsica, 2-4 May 1977
(ISL-CO-206/77) Avail: NTIS HC A02/MF A01

Pressure variations occurring in the inner ear of a guinea pig during exposure to impulse noise with different physical parameters were studied experimentally. Results concerning the intercochlear pressure amplitude were related to the middle ear transfer function determined from cochlear microphone potential measurements.
ESA

N78-23708# Joint Publications Research Service, Arlington, Va.

SPACE BIOLOGY AND AEROSPACE MEDICINE, VOLUME 12, NO. 2

11 May 1978 134 p refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), v. 12, no. 2, 1978 p 1-73 (JPRS-71096) Avail: NTIS HC A07/MF A01

Topics covered include cosmonaut selection and training, the evaluation and analysis of accumulated data to facilitate ongoing transition from orbital to interplanetary flights; human tolerance during long term flight; space psychology and physiology, spacecraft environments, and biotelemetry. For individual titles, see N78-23709 through N78-23723.

N78-23709# Joint Publications Research Service, Arlington, Va.

PRINCIPLES OF ENGINEERING PSYCHOLOGY INVOLVED IN OPTIMIZING CONTROL SYSTEMS OF AIRCRAFT AND SPACECRAFT **c53**

V. A. Bodrov and G. M. Zarakovskiy *In its* Space Biol. and Aerospace Med., Vol. 12, No. 2 (JPRS-71096) 11 May 1978 p 7-15 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), v. 12, no. 2, 1978 p 8-14 (For availability see N78-23708 14-51)
Avail: NTIS HC A07/MF A01

Experience in operating new aviation and space technology shows that the engineering-psychological flaws of control systems cannot be compensated solely by screening, educating, and training personnel. The patterns of activity of pilots and other crew members must be reflected in the control circuits and systems of flight vehicles. The conformity of the information model with the pilot's conception of the spatial location of the vehicle and with the time organization of attention must be considered. In choosing algorithms, provision must be made for reducing the number of operations to be performed by man and optimizing the layout of information and motor fields.
A.R.H.

N78-23710# Joint Publications Research Service, Arlington, Va.

IMMUNOLOGICAL REACTIVITY AND PREDICTION OF ALLERGIC COMPLICATIONS IN THE CREW OF THE SECOND EXPEDITION OF SALYUT-4 **c52**

I. V. Konstantinov, Yu. G. Nefedov, A. V. Yeremin, V. I. Drozdova, A. S. Skryabin, O. A. Guseva, and N. N. Mukhina *In its* Space Biol. and Aerospace Med., Vol. 12, No. 2 (JPRS-71096) 11 May 1978 p 16-21 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), v. 12, no. 2, 1978 p 15-19 (For availability see N78-23708 14-51)
Avail: NTIS HC A07/MF A01

A combination of factors in long term space flight significantly increase the probability of allergic and autoimmune disturbances. Sensitization to allergens of the main human microbial autoflora was evaluated as well as the immunological reactivity of crew members of the Salyut-4 space station before and after the 63 day mission. Examination of the blood taken from the cubital vein revealed the quantitative characteristics of T and B type lymphocytes involved in the main immunological reactions. Indices of specific immunological activity on preflight, and on the 2d and 7th day post flight are presented in tables. The necessity for including allergy tests in the screening and training of astronauts is discussed.
Author

N78-23711# Joint Publications Research Service, Arlington, Va.

STUDIES OF REACTIVITY OF THE ORGANISM USING SOME PHARMACOLOGICAL TESTS

T. N. Krupina, Kh. Kh. Yarullin, A. Ya. Tizul, V. P. Barkhatova, M. P. Aleksandrova, and N. P. Belyakov *In its* Space Biol. and Aerospace Med., Vol. 12, No. 2 (JPRS-71096) 11 May 1978 p 22-28 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), v. 12, no. 2, 1978 p 19-24 (For availability see N78-23708 14-51)
Avail: NTIS HC A07/MF A01

The activity of the sympathoadrenal system was studied by investigating the metabolism and biosynthesis of catecholamine and its precursors in 34 male subjects following insulin injection and depravein intake. The dynamics of excretion of epinephrine, morepinephrine, dopamine, and dopa precursors was examined as well as bioelectrical activity (EEG) and cerebral blood flow. Thermoregulation, the state of the cardiovascular system, and the sugar curve were also tested. Insulin and depravein, which have a selective mechanism of action on catecholamine metabolism can be used as functional load tests in dynamic studied of the state and reactivity of the human sympathoadrenal system.
A.R.H.

N78-23712# Joint Publications Research Service, Arlington, Va.

CONSUMPTION OF FREEZE-DRIED FOOD IN WEIGHTLESSNESS **c54**

L. L. Gerdauskene, R. V. Kudrova, N. D. Radchenko, G. N. Savel'yeva, and A. A. Simakov *In its* Space Biol. and Aerospace Med., Vol. 12, No. 2 (JPRS-71096) 11 May 1978 p 29-33 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), v. 12, no. 2, 1978 p 25-28 (For availability see N78-23708 14-51)
Avail: NTIS HC A07/MF A01

Foods with specific indices of surface tension, adhesiveness and viscosity can be consumed in weightlessness. Six freeze-dried foods of various consistency, whose viscosity was regulated by a latering moisture content of the product or adding modified starch for thickening were tested to determine the consistency that is most convenient for intake in weightlessness using ordinary flatware. Sufficient viscosity and adhesiveness were found in mashed potatoes with a moisture content of 75-85%, cottage cheese pudding with 60 and 70 moisture, cottage cheese with mashed black currants with 50% moisture, and cottage cheese with nuts with 50 66% moisture. Foods such as stew with fat and noodles with meat, prepared using conventional technology, were unsuitable regardless of their consistency.
Author

N78-23713# Joint Publications Research Service, Arlington, Va.

CHECKING EFFECTIVENESS OF PREVENTION OF HIGH-ALTITUDE DECOMPRESSION DISORDERS BY MEANS OF PREBREATHING IN AN OXYGEN ENVIRONMENT **c52**

R. T. Kazakova and I. P. Poleshchuk *In its* Space Biol. and Aerospace Med., Vol. 12, No. 2 (JPRS-71096) 11 May 1978 p 34-38 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), v. 12, no. 2, 1978 p 28-31 (For availability see N78-23708 14-51)
Avail: NTIS HC A07/MF A01

The heart, respiration rate, and arterial pressure were monitored during tests conducted in a pressure chamber to determine whether completeness and effectiveness of denitrogenization during pure oxygen breathing affects penetration of

nitrogen through the integument. Data obtained during ascents to 11,000 m altitude with the performance of exercises and prebreathing for 5, 6, and 8 hours are presented and compared with results obtained without pressure suits. No substantial differences with regard to decompression disorders were revealed. No particular differences were demonstratable with regard to intensity of pain and altitude at which symptoms of decompression disturbances disappeared. Evidently, the nitrogen that penetrates through the integument when an individual breaths pure oxygen in an air atmosphere does not affect the development of decompression disorders. Author

N78-23714# Joint Publications Research Service, Arlington, Va

SOME PROBLEMS OF PATHOGENESIS OF RESPIRATORY DISORDERS OCCURRING AT +G SUB z ACCELERATIONS COMBINED WITH BREATHING PURE OXYGEN c52

M. A. Tikhonov, A. V. Kondakov, V. I. Babushkin, D. Yu. Arkhangelskiy, and D. N. Gavrilyuk *In its* Space Biol. and Aerospace Med., Vol. 12, No. 2 (JPRS-71096) 11 May 1978 p 39-46 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), v. 12, no. 2, 1978 p 32-38 (For availability see N78-23708 14-51)

Avail: NTIS HC A07/MF A01

Six healthy males, ranging in age from 20 to 23 years and wearing anti-G suits were subjects in a series of tests conducted on a centrifuge to determine the significance of various factors which lead to the onset and development of functional disorders of the respiratory system. All subjects were exposed to each factor twice, once while breathing air, and once while breathing pure oxygen. Changes in the functional state of the respiratory system were evaluated before and after each acceleration on the basis of subjective sensations and the results of spirographic examination. The biophysical bases of the process of atelectasizing of the lungs in the presence of accelerations combined with breathing pure oxygen were demonstrated. The severity of functional disturbances of the respiratory system depends on the magnitude and duration of accelerations, but the time factor is more important. The theoretical conception of pathogenesis of pulmonary atelectases warrants the assumption that the duration of prebreathing, the time during which the subject breathes pure oxygen prior to exposure to accelerations, has influence on the intensity of the respiratory disorders. Author

N78-23715# Joint Publications Research Service, Arlington, Va.

POSSIBILITY OF RETAINING THERMAL BALANCE OF THE HUMAN BODY IN AN EXTREMELY RAREFIED ATMOSPHERE BY MEANS OF VACUUM EVAPORATION OF PERSPIRATION FROM THE BODY SURFACE c52

I. N. Chernyakov *In its* Space Biol. and Aerospace Med., Vol. 12, No. 2, (JPRS-71096) date p 47-51 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), v. 12, no. 2, 1978 p 38-41 (For availability see N78-23708 14-51)

Avail: NTIS HC A07/MF A01

The dynamics of heat transfer were studied in 64 tests conducted on 24 subjects with prolonged (3-8 h) exposure to high (up to 40-55C) ambient temperature at rest and while performing exercises associated with energy expenditure of up to 2.5 kcal min. to determine the effectiveness of vacuum perspiration in retaining thermal homeostasis in man in the presence of exogenous and endogenous heat loads in a rarefied atmosphere. Subjects were lifted to an altitude of 25 km in gear consisting of a pressure helmet and an altitude-compensating nylon-6 jumpsuit having a thin rubber liner converging the trunk and limbs and connected to the PH and oxygen gear to regulate excess pressure in the helmet and lungs. With lowering of the pressure in chamber, the appropriate rarefication was generated under the liner. Perspiration boiled on the body surface and vapor passed through the pores of the underwear into a collector and was removed. Vacuum evaporation prevented overheating of the body effectively at a temperature of 40 C and with the performance of mild exercise. The heat transfer conditions did not restrict man's endurance of thermal stress. Author

N78-23716# Joint Publications Research Service, Arlington, Va.

INFLUENCE OF LOCATION OF INDICATORS ON PSYCHOPHYSIOLOGICAL DISTINCTIONS OF COMBINED ACTIVITY c53

V. A. Bodrov and Iv Ye. Doroshenko *In its* Space Biol. and Aerospace Med., Vol. 12, No. 2 (JPRS-71096) 11 May 1978 p 52-56 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), v. 12, no. 2 1978 p 42-45 (For availability see N78-23708 14-51)

Avail: NTIS HC A07/MF A01

The efficiency of combined solving of problems varying in psychological structure is related to the mutual position of displays, as well as the importance of the problem, and is determined by the nature of sharing attention. Ten healthy males ranging in age from 20 to 35 years, were seated in an armchair with a headrest in such a position that the tracking display was in line with his eyes, and the screen on which the problem was presented was under it, at angles of 0-2, 15, 30, 45, and 60 deg from the vertical angle of vision. Problem investigation included: (1) unidimensional tracking of a sinusoidal function signal (0.1 Hz and 40 mm amplitude); (2) visual gauging of the distance between an object velocity of the object; and (3) sensorimotor choice reaction to presentation of one out of two light signals. Author

N78-23717# Joint Publications Research Service, Arlington, Va.

HUMAN VISUAL FUNCTIONS AS RELATED TO MILD VESTIBULAR STIMULI c52

V. I. Kartsev and A. A. Shipov *In its* Space Biol. and Aerospace Med., Vol. 12, No. 2 (JPRS-71096) 11 May 1978 p 57-62 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), v. 12, no. 2, 1978 p 45-49 (For availability see N78-23708 14-51)

Avail: NTIS HC A07/MF A01

The effect of mild stimulation of otolithic and cupular receptors on the visual efficiency of man was measured in subjects wearing opaque glasses to rule out optokinetic stimuli. Reactions measured include: (1) time of appearance of Purkinje's phenomenon and dark adaptation; (2) thresholds of color discrimination after stimulation; and (3) the restoration of central vision. A.R.H.

N78-23718# Joint Publications Research Service, Arlington, Va.

HUMAN ENDURANCE OF MEASURED EXERCISE IN THE PRESENCE OF CHRONIC HYPERCAPNIA c52

G. L. Apanasenko, V. S. Shchegolev, and V. I. Kuleshov *In its* Space Biol. and Aerospace Med., Vol. 12, No. 2 (JPRS-71096) 11 May 1978 p 63-67 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), v. 12, no. 2, 1978 p 49-52 (For availability see N78-23708 14-51)

Avail: NTIS HC A07/MF A01

The effect of prolonged exposure of high concentrations of CO2 on the human body was studied in subjects working under conditions of prolonged isolation and hypokinesia. The amount of CO2 in the inhaled air was in the range of 0.8-1.8% at normal atmospheric pressure, while the level of motor activity constituted 1000-1500 locomotions per day. The heart rate, arterial pressure, vital capacity and excursion of the thorax were measured as well as results of functional tests with measured exercise and breath holding, oxyjemometry, and examination of blood alkaline reserve. In the first week of isolation, changes occur that are inherent in the effects of high concentrations of the gas, which reached a maximum on the 45th day of the test. Author

N78-23719# Joint Publications Research Service, Arlington, Va.

FUNCTIONAL RESERVES OF THE CARDIAC SYMPATHETIC SYSTEM IN THE PRESENCE OF HYPOXIA c52

N. K. Khitrov and A. M. Alaverdyan *In its* Space Biol. and Aerospace Med., Vol. 12, No. 2 (JPRS-71096), 11 May 1978 p 68-72 refs Transl. into ENGLISH from Kosm. Biol. i. Aviakosm. Med. (Moscow), v. 12, no. 2, 1978 p 53-56 (For availability see N78-23708 14-51)

Avail: NTIS HC A07/MF A01

The degree of resistance to hypoxia in male albino rats was compared to the capacity of the sympathetic systems of the heart to stabilize the norepinephrine level. A spectrophotometer and the trioxyindole method were used to estimate changes in dopa and norepinephrine content under the influence of test

hyposia for 20 and 60 min, and in control rats and in animals submitted to adaptation to hypoxia lasting 21 and 35 days. Hypertrophy of the myocardium gradually increased with increase in duration of hypoxia. However, optimum supply of norepinephrine to the heart, as a result of increased functional reserves of cardiac sympathetic systems is possible only up to a specific degree of hypertrophy of such genesis. The capability of adrenergic structures of the heart changes in the same direction as the change in resistance of the organism to hypoxia. Author

N78-23720# Joint Publications Research Service, Arlington, Va.

MOTOR ACTIVITY AND PREVENTION OF CONSEQUENCES OF HYPOKINESIA (ON THE BASIS OF INDICES OF TISSULAR METABOLISM) c52

I. V. Fedorov *In its* Space Biol. and Aerospace Med., Vol. 12, No. 2 (JPRS-71096) 11 May 1978 p 73-7 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), v. 12, no. 2, 1978 p 56-61 (For availability see N78-23708 14-51)

Avail: NTIS HC A07/MF A01

The total protein and nucleic acid (DNA and RNA) content of the tissues of the liver, kidney, brain, and gastrochemius muscle of 240 mongrel albino rats decapitated on the 15, 20, 60, and 90th day were examined to determine the effectiveness of various exercise programs in preventing the consequences of hypokinesia. In the case of long-term hypokinesia, there is reorganization of metabolic processes that have a substantial influence on the composition and properties of tissues. The slow and uneven normalization in the recovery period is attributed to some metabolic sluggishness of altered tissues, and the effect of movement against the background of prior kinesia as a unique stimulus. A.R.H.

N78-23721# Joint Publications Research Service, Arlington, Va.

DEVELOPMENT OF NEOPLASMS IN DOGS AFTER CHRONIC EXPOSURE TO GAMMA RADIATION DELIVERED AT A LOW DOSE RATE

V. I. Yakovleva *In its* Space Biol. and Aerospace Med., Vol. 12, No. 2 (JPRS-71096) 11 May 1978 p 80-86 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), v. 12, no. 2, 1978 p 61-67 (For availability see N78-23708 14-51)

Avail: NTIS HC A07/MF A01

The incidence, localization, and nature of tumors revealed by pathoanatomical examination of 80 dogs which died or were sacrificed within 5 years of chronic continuous irradiation from Co-60 sources are discussed. With increased duration of chronic irradiation, the endocrine glands presented focal hyperplastic changes in addition to dystrophic, atrophic, and sclerotic changes. Both malignant and benign neoplasms developed in the glands. A.R.H.

N78-23722# Joint Publications Research Service, Arlington, Va.

EXPERIMENTAL SUBSTANTIATION OF MAXIMUM PERMISSIBLE CONCENTRATIONS OF ACETONE AND ACETALDEHYDE IN RECLAIMED POTABLE WATER c54

N. I. Omel'yanets, N. V. Mironets, N. V. Martyshchenko, I. A. Gubareva, L. F. Piven, and S. N. Starchenko *In its* Space Biol. and Aerospace Med., Vol. 12, No. 2 (JPRS-71096) 11 May 1978 p 87-91 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), v. 12, no. 2, 1978 p 67-70 (For availability see N78-23708 14-51)

Avail: NTIS HC A07/MF A01

Subacute and chronic experiments were conducted to demonstrate the toxic effects of acetone and acetyldehyde in albino rats. On the basis of comparison of threshold doses according to the organoleptic feature of action and ineffective doses according to the sanitary and toxicological factor, the maximum perishable concentration for acetone is 14.0 mg/lambda (0.7 mg/lambda kg) according to the sanitary and toxilogical factor index of deleteriousness. The concentration for acetaldehyde is 0.2 mg/lambda according to the organoleptic action. The recommended maximum perishable concentrations for reclaimed water to be consumed for 1 to 3 months are 39.6 mg/lambda for acetone and 0.2 mg/lambda for acedaldehyde. A.R.H.

N78-23723# Joint Publications Research Service, Arlington, Va.

THE COMBINED EFFECT OF VOLATILE PRODUCTS OF THERMAL OXIDATION DECOMPOSITION OF LUBRICATING OIL AND HYPOXIC HYPOXIA ON THE ORGANISM c52

V. V. Kustov and V. G. Litau *In its* Space Biol. and Aerospace Med., Vol. 12, No. 2 (JPRS-71096) 11 May 1978 p 92-95 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), v. 12, no. 2, 1978 p 70-73 (For availability see N78-23708 14-51)

Avail: NTIS HC A07/MF A01

The toxic effects of the mixed volatile products of the thermal oc oxidation decomposition of 36/1KUA lubricant were studied in 80 white mice following exposure to the mixture for 4 h at ground barometric pressure in a chamber, as well as in three additional groups of like number that were exposed simultaneously to the same mixture and hypoxic hypoxia in a rarefaction corresponding to altitudes of 5,000, 7,000, and 8,000 m respectively. The intensity of oxygen uptake and the mortality rates at the different altitudes are discussed. At the same level of intensity of mixture, the toxic effect in the presence of hypoxia increases with increase in degree of rarefaction, and conversely, with the same level of the latter, the deleterious influence of the mixture on the overall effect of both factors increases with increase in level thereof in inhaled air. A.R.H.

N78-23724# Joint Publications Research Service, Arlington, Va.

TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: BIOMEDICAL AND BEHAVIORAL SCIENCES, NO. 28. EFFECTS OF NONIONIZING ELECTROMAGNETIC RADIATION

18 May 1978 56 p refs Transl. into ENGLISH from various Russian journals

(JPRS-71136) Avail: NTIS HC A04/MF A01

The response of biological systems to nonionizing electromagnetic radiation was explored. The types of radiation used included electromagnetic fields, electric fields, and alternating magnetic fields. Immunological, biochemical, and metabolic responses were evaluated as well as the whole organism response in some cases. For individual titles, see N78-23725 through N78-23732.

N78-23725# Joint Publications Research Service, Arlington, Va

EFFECTS OF LOW-FREQUENCY (50 Hz) ELECTROMAGNETIC FIELD ON FUNCTIONAL STATE OF THE HUMAN BODY c52

Yu. D. Dumanskiy, V. M. Popovich, and I. P. Kozyarin *In its* Transl. on USSR Sci. and Technol.: Biomed. and Behavioral Sci., No. 28 (JPRS-71136) 18 May 1978 p 1-5 Transl. into ENGLISH from Gig. Sanit., (Moscow), no. 12, 1977 p 32-35 (For availability see N78-23724 14-51)

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Several series of observations of the physical condition of volunteers were conducted in order to study the biological effects of industrial frequency electromagnetic fields (IFEMF) of varying intensity. The observations were conducted under natural conditions, i.e., directly in areas of superhigh voltage power lines. One group stayed in the IFEMF generated by 330 kV power lines for 2 hours daily, for 30 days. The second and third groups were exposed to the IFEMF, 750 kV power lines, 3 times a day for 30 minutes, with 1 hour intervals between exposure, for 6 days. A number of physiological parameters were examined to evaluate the effects of IFEMF on the functional state of the body. The observations of the health status of volunteers exposed to IFEMF indicate that this is a biologically active environmental factor and that the extent of its activity is related to the intensity and duration of exposure. P.R.A.

N78-23726# Joint Publications Research Service, Arlington, Va.

EFFECT OF ENERGY OF SUPERHIGH-FREQUENCY ELECTROMAGNETIC FIELDS ON THE BODIES OF EXPERIMENTAL ANIMALS UNDER DIFFERENT CONDITIONS OF ULTRAVIOLET IRRADIATION

R. D. Gabovich and O. I. Shutenko *In its* Transl. on USSR Sci. and Technol.: Biomed. and Behavioral Sci., No. 28 (JPRS-71136)

18 May 1978 p 6-14 refs Transl. into ENGLISH from Gig. Tr. Prof. Zabol. (Moscow), no. 9, 1977 p 31-37 (For availability see N78-23724 14-51)
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Male albino rats were subjected to an electromagnetic field with a frequency of 2,840 mc and varying doses of ultraviolet radiation close in its spectrum to solar radiation. The physiological parameters evaluated were: body weight, work fitness, latent time of defensive reflex reaction to electric stimulation, blood serum cholinesterase activity, content of SH-groups in the blood, immunological indicators, and exchange of trace elements. A 4 month daily (3 hour) dosage of superhigh frequency energy produced unfavorable changes in the parameters studied in experimental rats kept under conditions of ultraviolet deficit. Irradiation of animals with ultraviolet rays increased their tolerance for the effect of superhigh frequency energy. The effect of a superhigh frequency field with an excess of ultraviolet irradiation approximates the effects observed with ultraviolet deficit. For preventive purposes, it is advisable to control the ultraviolet conditions of workers subjected to the effects of superhigh frequency electromagnetic fields. P.R.A.

N78-23727# Joint Publications Research Service, Arlington, Va.

DISTINCTIVE REACTIONS OF THE BODY'S IMMUNOLOGICAL SYSTEM TO THE COMBINED EFFECTS OF PHYSICAL AND CHEMICAL ENVIRONMENTAL FACTORS

G. I. Vinogradov and A. N. Marzeyev *In its* Transl. on USSR Sci. and Technol.: Biomed. and Behavioral Sci., No. 28 (JPRS-71136) 18 May 1978 p 15-19 refs Transl. into ENGLISH from Gig. Sanit. (Moscow), no. 10, 1977 p 28-31 (For availability see N78-23724 14-51)
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The patterns of immune reactions of the organism to superhigh frequency electromagnetic fields (SHF EMF) were studied at different levels of energy flow density and in combination with two common air pollutants, formaldehyde and carbon monoxide. A group of guinea pigs were exposed to the separate effects of SHF EMF, formaldehyde alone, or carbon monoxide alone. A second group received exposure to the chemicals against a background of prior irradiation, while a third group consisted of animals irradiated after prior administration of the chemicals. The combined effect of formaldehyde and SHF EMF led to a depression of all phagocytic indices studies and complement titer. Exposure of carbon monoxide treated animals to SHF EMF led to stimulation of the phagocytic reaction and elevation of complement titer. The result of combined exposure to the SHF EMF and chemical agents is determined by the nature and extent of the sensitizing effect of each of the physical and chemical environmental factors studied. P.R.A.

N78-23728# Joint Publications Research Service, Arlington, Va.

THE EFFECT OF ELECTROMAGNETIC FIELDS ON ENZYME ACTIVITY

S. L. Arber *In its* Transl. on USSR Sci. and Technol.: Biomed. and Behavioral Sci., No. 28 (JPRS-71136) 18 May 1978 p 20-23 refs Transl. into ENGLISH from Elektron. Obrab. Mater. (Kishinev), no. 1, 1978 p 63-65 (For availability see N78-23724 14-51)
Copyright. Avail: NTIS HC A04/MF A01

The manner in which the dielectric relaxation of molecules of a polar reagent affects the kinetics of a chemical reaction was shown. The electromagnetic field influences the rotatory diffusion of polar molecules taking part in the reaction, which in turn decreases the probability of contact of the active center of the molecule with the substrate. It is the precise orientation of the catalytic groups which is necessary for enzyme catalysis, and when the groups are polar the effect of an electromagnetic field will slow the enzyme reaction. This conclusion was used to explain the fact that certain enzymes have decreased activity in electromagnetic fields, while the activity of others remains insensitive to microwave irradiation. P.R.A.

N78-23729# Joint Publications Research Service, Arlington, Va.

REACTION OF CENTRAL AND PERIPHERAL MEDIATOR ELEMENTS OF THE SYMPATHOADRENAL SYSTEM TO SINGLE EXPOSURE TO ALTERNATING MAGNETIC FIELD

S. A. Sakharova, A. I. Ryzhov, and N. A. Udintsev *In its* Transl. on USSR Sci. and Technol.: Biomed. and Behavioral Sci., No. 28 (JPRS-71136) 18 May 1978 p 24-30 refs Transl. into ENGLISH from Biol. Nauki (Moscow), no. 9, 1977 p 35-39 (For availability see N78-23724 14-51)
Copyright. Avail: NTIS HC A04/MF A01

Phasic changes were demonstrated in levels of catecholamines and dopa in the central and peripheral mediator elements of the sympathoadrenal system following single exposure of male rats to an alternating magnetic field for 24 hours. In the first phase there was increased uptake of dopamine and epinephrine in the brain stem, norepinephrine in the hypothalamus, intensified transfer of epinephrine from blood to the heart and liver, and increased norepinephrine content of the liver and spleen. In the second phase, the epinephrine level remained low in brain stem tissues, norephrine content remained high in the liver and spleen and reverted to normal in the heart and hypothalamus. In the third phase, catecholamine levels dropped in all organs with the exception of the heart. Author

N78-23730# Joint Publications Research Service, Arlington, Va.

COPPER, MOLYBDENUM, IRON AND MANGANESE METABOLISM IN RAT TISSUES IN RESPONSE TO A 50 Hz ELECTRIC FIELD

R. D. Gabovich, I. P. Kozyarin, I. A. Mikhalyuk, and L. D. Fesenko *In its* Transl. on USSR Sci. and Technol.: Biomed. and Behavioral Sci., No. 28 (JPRS-71136) 18 May 1978 p 31-38 refs Transl. into ENGLISH from Ukr. Biokhim. Zh. (Kiev), no. 2, 1978 p 206-211 (For availability see N78-23724 14-51)
Copyright. Avail: NTIS HC A04/MF A01

Male rats were exposed to electric fields of different intensities in order to study the change in distribution of copper, molybdenum, iron, and manganese in their tissues. Different groups were exposed to field intensities of 7, 12, 15 kv/meter respectively for 30 minutes each day for 4 months. Urine and feces were collected 30 minutes each day to determine microelement concentrations and the animals were then decapitated. Tissue copper, molybdenum, iron, and manganese concentration were determined by spectrographic methods. Results indicate that exposure of the bodies of experimental animals to an industrial frequency electric field causes a change in the distribution of the analyzed microelements in organs and tissues, the extent of these changes depending on field intensity. P.R.A.

N78-23731# Joint Publications Research Service, Arlington, Va.

EVALUATION OF HYGIENIC SIGNIFICANCE OF ELECTRIC FIELD OF POWER LINES IN POPULATED AREAS c52

I. P. Kozyarin and V. M. Popovich *In its* Transl. on USSR Sci. and Technol.: Biomed. and Behavioral Sci., No. 28 (JPRS-71136) 18 May 1978 p 39-44 refs Transl. into ENGLISH from Vrach. Delo (Kiev), no. 11, 1977 p 120-124 (For availability see N78-23724 14-51)
Copyright. Avail: NTIS HC A04/MF A01

Experiments were performed to demonstrate the correlation between intensity and duration of exposure to an electric field and the biological effects this factor induces. Male rats were put in special cages, with simulation of a 50 Hz field generated by means of high voltage transformers. Physiological and biochemical tests were performed prior to the experiment, monthly, and 30 days after irradiation. They included examination of organs and physiological systems that are the most sensitive to electromagnetic fields. Electric fields of 7 and 15 kV/m were the biologically effective levels for 2 hour daily exposures over a 4 month period. All observed changes were reversible and there was normalization within a month after discontinuing irradiation. Positive correlation was shown between the severity of biological effects and the time of exposure and intensity of the field. P.R.A.

N78-23732# Joint Publications Research Service, Arlington, Va.

ELECTROMAGNETIC FIELD ON GROWTH AND DEVELOPMENT OF PLANTS

A. I. Belskiy *In its* Transl. on USSR Sci. and Technol.: Biomed. and Behavioral Sci., No. 28 (JPRS-71136) 18 May 1978

p 45-48 refs Transl. into ENGLISH from Elektron. Obrab. Mater. (Kishinev), no. 6, 1977 p 69-71 (For availability see N78-23724 14-51)
Avail: NTIS HC A04/MF A01

In order to assess the effects of the earth's magnetic field on plants and their shape, a model was constructed, in which the earth's magnetic field was simulated with a direct current field. The results indicated that plants and seedlings grow slower and there is 10 to 12 cm less increment of runners per vegetation than in the control, when they are in the zone of a strong electromagnetic field. P.R.A.

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N78-23733 Indiana Univ., Bloomington.
INVESTIGATION OF A NEW CARDIAC ARRHYTHMIA MONITORING SCHEME Ph.D. Thesis
John Kitchen Cuddeback 1977 312 p
Avail: Univ. Microfilms Order No. 78-05628

A monitoring scheme was proposed that addressed recognized limitations of currently implemented CCU monitors. With only one additional ECG electrode, the spatial magnitude of the projection of the cardiac vector onto the frontal plane was computed; this signal was much less susceptible to geometric ambiguity than were bipolar leads. Parameters were reliably measured; the interbeat interval, which revealed the rhythmic behavior of the cardiac pacemaker, and the duration of the ventricular complex, which corresponded to the conduction velocity of the ventricular depolarization wave. Dissert. Abstr.

N78-23734* + National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 179
Apr. 1978 58 p
(NASA-SP-7011(179)) Avail: NTIS HC E02 CSCL 06E

This biliography lists 171 reports, articles, and other documents introduced into the NASA scientific and technical information system in March 1978. Author

N78-23735# Electrotechnical Lab., Tokyo (Japan).
SPATIAL FREQUENCY RESPONSES OF THE HUMAN VISUAL SYSTEM
Takashi Nagano Oct. 1977 109 p refs In JAPANESE; ENGLISH summary
(Circ-193) Avail: NTIS HC A06/MF A01

Effects of various temporal factors such as, the flicker, drift, exposure duration, etc., on the modulation transfer function are surveyed. Effects of other factors such as the mean luminance of the screen, subtending visual angle of the screen, viewing distance, etc., on the modulation transfer function are summarized. Many findings for the multiple channel theory are described. Many neurophysiological studies on the responses of single cells to gratings are described. Effects of color on the modulation transfer function, a few findings on the two-dimensional modulation transfer function and some other findings on the modulation transfer function are also described. Author

N78-23736# Royal Aircraft Establishment, Farnborough (England).
THE EFFECT OF THE BENZODIAZEPINE ADUMBRAN ON THE RESTING AND SLEEP EEG AND ON THE VISUAL EVOKED POTENTIAL IN ADULT MAN
G. Dolce and E. Kaemmerer 1 Oct. 1976 14 p refs Transl. into ENGLISH from Med. Welt (West Ger.), no. 9, 1967 p 510-514
(RAE-Lib-Trans-1906; BR55679) Avail: NTIS HC A02/MF A01; HMSO; PHI

The administration of 20 to 40 mg of Adumbran gave rise to no significant clinical changes in vigilance in the waking state and no appreciable change in the EEG pattern, particularly as regards frequency. In tests to determine psychic disturbances after eliminating or shortening paradoxical sleep, the effect of Adumbran on the sleep EEG was recorded polygraphically. The overall duration of sleep lengthened under medication, with a simultaneous intensification of slow sleep. The visual evoked potential suffered only a slight reduction in amplitude, while there was no appreciable increase in latency. Author

N78-23737# Connecticut Univ., Storrs. Dept. of Electrical Engineering and Computer Science.
A CROSSED BEAM DOPPLER ULTRASOUND CONCEPT FOR IMPROVED DETECTION OF ATHEROSCLEROSIS Annual Report, 1 Jun. 1976 - 31 Aug. 1977
Martin D. Fox 15 Nov. 1977 51 p refs
(Contract N01-HV-5-2863-2)
(PB-276859/6; NIH-N01-HV-5-2963-2) Avail: NTIS HC A04/MF A01 CSCL 06B

A unique duplex Doppler and B-mode ultrasonography device was designed and a prototype constructed, for noninvasive detection, quantification, and visualization of atherosclerotic lesions and associated modifications in blood flow. The prototype included a computer controlled linear phased array for electronic B scan, and a unique Doppler velocimeter arrangement that employed multiple pairs of crossed transmit beams to obtain a calibrated indication of flow velocity and turbulence. GRA

N78-23738# Army Medical Research Inst. of Infectious Diseases, Frederick, Md.
DISTRIBUTION OF TISSUE WATER AND ELECTROLYTES IN NORMAL RHESUS MACAQUES Interim Report
C. T. Liu and M. J. Griffin 2 Mar. 1978 18 p
(AD-A052019) Avail: NTIS HC A02/MF A01 CSCL 06/16

Techniques for the determination of water and electrolytes in individual tissues of normal rhesus monkeys are described. Base-line values for intracellular and extracellular distribution of water and electrolytes in 14 different tissues including skin, skeletal muscle (gastrocnemius), cardiac muscle (left ventricle), lung, diaphragm, liver, renal cortex, outer medulla and inner medulla, cerebral cortex, cerebellum, thalamus-hypothalamus complex, medulla oblongata, and spinal cord are presented. Author (GRA)

N78-23739# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
BIOMECHANICAL AND PERFORMANCE RESPONSE OF MAN IN SIX DIFFERENT DIRECTIONAL AXIS VIBRATION ENVIRONMENTS
William H. Levison and Cariold B. Harrah Sep. 1977 91 p refs
(Contract F33615-76-C-5015)
(AD-A052069; BBN-3343; AMRL-TR-77-71) Avail: NTIS HC A05/MF A01 CSCL 06/4

A series of experiments was performed to explore biodynamic response and tracking performance in various whole-body vibration environments. The primary experimental variable was the direction of the vibration: X-pitch, Y-roll, Z, roll, pitch, and yaw. Tracking axis (pitch or roll) and control-stick spring constant were additional experimental variables. Data from these experiments were analyzed to derive engineering descriptions of biodynamic response and tracking behavior, and a model was developed to relate tracking performance to biodynamic response parameters. Author (GRA)

N78-23740# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
NONLINEAR BIOMECHANICAL MODEL OF THE CERVICAL-THORACIC TRANSREGIONAL JOINT Ph.D. Thesis
William C. Eddy Jun. 1977 96 p refs
(AD-A052068; AMRL-TR-76-90) Avail: NTIS HC A05/MF A01 CSCL 06/4

A two dimensional model of the cervical-thoracic transregional joint is developed, which incorporates vertebra geometry and the measured material response properties of the ligaments and intervertebral disc. The model provides a useful tool for the parametric study of the effects of anatomical elements on the overall joint motion. In the model, the joint motion is restricted to the sagital plane, and the articulating facet surfaces for the adjacent vertebrae are represented by two curves. The requirement that point contact be maintained between these curves constitutes a kinematic constraint on the relative motion between the two vertebrae. The model considers the vertebrae to be rigid bodies and the masses of the vertebrae are neglected. The

characterization of the velocity dependent response of the anterior and posterior longitudinal ligaments is based on a set of experiments in which load versus deflection data were generated at deflection rates of 0.5 and 1 inch per second. From these data, a constitutive equation is derived, consisting of a third order polynomial of the deflection plus a fifth term, the product of an arbitrary constant, the deflection and the deflection velocity. GRA

N78-23741# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EXPERIMENTAL ANALYSIS OF THE INFORMATION CONTENT OF AN AURAL ELECTRICAL FIELD OF THE HUMAN BODY

P. I. Gulyayev and V. I. Zabotin 10 Aug. 1977 13 p Transl. into ENGLISH from Nervnaya Sistema (USSR), no. 11, 1970 p 145-149

(AD-A051096; FTD-ID(RS)T-1340-77) Avail: NTIS HC A02/MF A01 CSCL 06/2

This paper discusses the electromagnetic fields of the 'electrical aura' around living substances which carry information about the functional state of the body's organs. Two sources of 'aural' fields have been discovered. The first is the internal fluctuating electrotonic field of the body's active organs while the second is the triboelectrical static changes of the body's surfaces. This paper describes a procedures for recording the variable electrical component of 'aural' fields. GRA

N78-23742# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.

THE 'PROTECTION AGAINST X-RAY DAMAGES ACT' OF 1973 PROMULGATED BY THE GERMAN FEDERAL REPUBLIC

S. Risica 20 Nov. 1976 75 p In ITALIAN; ENGLISH summary

(ISS-R-76/13) Avail: NTIS HC A04/MF A01

The purpose of this Act was to regulate the use of X rays in industries and hospitals with special regard to the protection of the patients from unnecessary exposure. A comparison is made between the principal points contained in the German law and the I.C.R.P. Publication n.15 'protection against Ionizing Radiation from External Sources'. A translation of the German Act into Italian is annexed. Author (ESA)

N78-23743# National Physical Lab., Teddington (England).

TABLES FOR THE ESTIMATION OF NOISE-INDUCED HEARING LOSS

D. W. Robinson and M. S. Shipton Jun. 1977 176 p refs Revised

(NPL-Ac-61-Rev) Avail: NTIS HC A09/MF A01

Tables are given of the essential parameters required to predict hearing loss due to long-term exposure to noise, in terms of the statistical distribution of hearing levels in non-pathological populations. A brief description of the formulation of the latter is also given together with examples of their use. ESA

N78-23744# National Physical Lab., Teddington (England).

HEARING HAZARD FROM OCCUPATIONAL NOISE: OBSERVATIONS ON A POPULATION FROM HEAVY INDUSTRY

W. Burns (London Univ.), D. W. Robinson, M. S. Shipton, and A. Sinclair (Brit. Steel Corp.) Jan. 1977 39 p refs

(NPL-Ac-80) Avail: NTIS HC A03/MF A01

A group of over 700 workers between the ages of 60 and 65 with long service in heavy industry were examined autodiometrically. Hearing levels for the whole group were compared with those of a normal sub-group having no auditory pathology other than that due to noise exposure. The difference in hearing levels is shown to account for divergencies in prediction of the incidence of occupational hearing loss between ISO Standard 1999 and British Standard 5330. The numerical analysis highlights the care needed in comparing audiometric data from different sources and has significant implications for the setting of industrial noise exposure limits. Author (ESA)

N78-23745 National Technical Information Service, Springfield, Va.

NIGHT VISION AND DARK ADAPTATION. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Feb. 1977

Pernell W. Crockett Mar. 1978 121 p Supersedes NTIS/PS-77/0187; NTIS/PS-76/0133; NTIS/PS-75/172 (NTIS/PS-78/0206/9; NTIS/PS-77/0187; NTIS/PS-76/0133; NTIS/PS-75/172) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 06P

Research reports are cited on the physiological aspects of night vision, as applied to human engineering for motor vehicle operators, pilots, military personnel, and other persons who must perform in low intensity illumination. GRA

N78-23710# Joint Publications Research Service, Arlington, Va.

IMMUNOLOGICAL REACTIVITY AND PREDICTION OF ALLERGIC COMPLICATIONS IN THE CREW OF THE SECOND EXPEDITION OF SALYUT-4

I. V. Konstantinov, Yu. G. Nefedov, A. V. Yeremin, V. I. Drozdova, A. S. Skryabin, O. A. Guseva, and N. N. Mukhina *In its* Space Biol. and Aerospace Med., Vol. 12, No. 2 (JPRS-71096) 11 May 1978 p 16-21 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), v. 12, no. 2, 1978 p 15-19 (For availability see N78-23708 14-51)

Avail: NTIS HC A07/MF A01

N78-23713# Joint Publications Research Service, Arlington, Va.

CHECKING EFFECTIVENESS OF PREVENTION OF HIGH-ALTITUDE DECOMPRESSION DISORDERS BY MEANS OF PREBREATHING IN AN OXYGEN ENVIRONMENT

R. T. Kazakova and I. P. Poleshchuk *In its* Space Biol. and Aerospace Med., Vol. 12, No. 2 (JPRS-71096) 11 May 1978 p 34-38 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), v. 12, no. 2, 1978 p 28-31 (For availability see N78-23708 14-51)

Avail: NTIS HC A07/MF A01

N78-23714# Joint Publications Research Service, Arlington, Va

SOME PROBLEMS OF PATHOGENESIS OF RESPIRATORY DISORDERS OCCURRING AT +G SUB z ACCELERATIONS COMBINED WITH BREATHING PURE OXYGEN

M. A. Tikhonov, A. V. Kondakov, V. I. Babushkin, D. Yu. Arkhangelskiy, and D. N. Gavrilyuk *In its* Space Biol. and Aerospace Med., Vol. 12, No. 2 (JPRS-71096) 11 May 1978 p 39-46 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), v. 12, no. 2, 1978 p 32-38 (For availability see N78-23708 14-51)

Avail: NTIS HC A07/MF A01

N78-23715# Joint Publications Research Service, Arlington, Va.

POSSIBILITY OF RETAINING THERMAL BALANCE OF THE HUMAN BODY IN AN EXTREMELY RAREFIED ATMOSPHERE BY MEANS OF VACUUM EVAPORATION OF PERSPIRATION FROM THE BODY SURFACE

I. N. Chernyakov *In its* Space Biol. and Aerospace Med., Vol. 12, No. 2, (JPRS-71096) date p 47-51 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), v. 12, no. 2, 1978 p 38-41 (For availability see N78-23708 14-51)

Avail: NTIS HC A07/MF A01

N78-23717# Joint Publications Research Service, Arlington, Va.

HUMAN VISUAL FUNCTIONS AS RELATED TO MILD VESTIBULAR STIMULI

V. I. Kartsev and A. A. Shipov *In its* Space Biol. and Aerospace Med., Vol. 12, No. 2 (JPRS-71096) 11 May 1978 p 57-62 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), v. 12, no. 2, 1978 p 45-49 (For availability see N78-23708 14-51)

Avail: NTIS HC A07/MF A01

N78-23718# Joint Publications Research Service, Arlington, Va.

HUMAN ENDURANCE OF MEASURED EXERCISE IN THE PRESENCE OF CHRONIC HYPERCAPNIA

G. L. Apanasenko, V. S. Shchegolev, and V. I. Kuleshov *In its*

Space Biol. and Aerospace Med., Vol. 12, No. 2 (JPRS-71096) 11 May 1978 p 63-67 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), v. 12, no. 2, 1978 p 49-52 (For availability see N78-23708 14-51)
Avail: NTIS HC A07/MF A01

N78-23719# Joint Publications Research Service, Arlington, Va.
FUNCTIONAL RESERVES OF THE CARDIAC SYMPATHETIC SYSTEM IN THE PRESENCE OF HYPOXIA
N. K. Khitrov and A. M. Alaverdyan *In its* Space Biol. and Aerospace Med., Vol. 12, No. 2 (JPRS-71096) 11 May 1978 p 68-72 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), v. 12, no. 2, 1978 p 53-56 (For availability see N78-23708 14-51)
Avail: NTIS HC A07/MF A01

N78-23720# Joint Publications Research Service, Arlington, Va.
MOTOR ACTIVITY AND PREVENTION OF CONSEQUENCES OF HYPOKINESIA (ON THE BASIS OF INDICES OF TISSULAR METABOLISM)
I. V. Fedorov *In its* Space Biol. and Aerospace Med., Vol. 12, No. 2 (JPRS-71096) 11 May 1978 p 73-7 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), v. 12, no. 2, 1978 p 56-61 (For availability see N78-23708 14-51)
Avail: NTIS HC A07/MF A01

N78-23723# Joint Publications Research Service, Arlington, Va.
THE COMBINED EFFECT OF VOLATILE PRODUCTS OF THERMAL OXIDATION DECOMPOSITION OF LUBRICATING OIL AND HYPOXIC HYPOXIA ON THE ORGANISM
V. V. Kustov and V. G. Litau *In its* Space Biol. and Aerospace Med., Vol. 12, No. 2 (JPRS-71096) 11 May 1978 p 92-95 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), v. 12, no. 2, 1978 p 70-73 (For availability see N78-23708 14-51)
Avail: NTIS HC A07/MF A01

N78-23725# Joint Publications Research Service, Arlington, Va.
EFFECTS OF LOW-FREQUENCY (50 Hz) ELECTROMAGNETIC FIELD ON FUNCTIONAL STATE OF THE HUMAN BODY
Yu. D. Dumanskiy, V. M. Popovich, and I. P. Kozyarin *In its* Transl. on USSR Sci. and Technol.: Biomed. and Behavioral Sci., No. 28 (JPRS-71136) 18 May 1978 p 1-5 Transl. into ENGLISH from Gig. Sanit., (Moscow), no. 12, 1977 p 32-35 (For availability see N78-23724 14-51)
Copyright. Avail: NTIS HC A04/MF A01

N78-23731# Joint Publications Research Service, Arlington, Va.
EVALUATION OF HYGIENIC SIGNIFICANCE OF ELECTRIC FIELD OF POWER LINES IN POPULATED AREAS
I. P. Kozyarin and V. M. Popovich *In its* Transl. on USSR Sci. and Technol.: Biomed. and Behavioral Sci., No. 28 (JPRS-71136) 18 May 1978 p 39-44 refs Transl. into ENGLISH from Vrach. Delo (Kiev), no. 11, 1977 p 120-124 (For availability see N78-23724 14-51)
Copyright. Avail: NTIS HC A04/MF A01

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N78-23746*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INSTRUCTOR AND STUDENT PILOTS' SUBJECTIVE EVALUATION OF A GENERAL AVIATION SIMULATOR WITH A TERRAIN VISUAL SYSTEM
Gary W. Kiteley (Auburn Univ., Ala.) and Randall L. Harris, Sr. Apr. 1978 34 p refs
(NASA-TM-78698) Avail: NTIS HC A03/MF A01 CSCL 05H

Ten student pilots were given a 1 hour training session in the NASA Langley Research Center's General Aviation Simulator by a certified flight instructor and a follow-up flight evaluation was performed by the student's own flight instructor, who has also flown the simulator. The students and instructors generally felt that the simulator session had a positive effect on the students. They recommended that a simulator with a visual scene and a motion base would be useful in performing such maneuvers as: landing approaches, level flight, climbs, dives, turns, instrument work, and radio navigation, recommending that the simulator would be an efficient means of introducing the student to new maneuvers before doing them in flight. The students and instructors estimated that about 8 hours of simulator time could be profitably devoted to the private pilot training. Author

N78-23747# Federal Aviation Administration, Washington, D. C.
RADAR TRAINING FACILITY PROGRAM IMPLEMENTATION PLAN
A. Asch (Mitre Corp.), G. Beeker (Mitre Corp.), and L. Wuebler Sep. 1977 163 p
(Contract DOT-FA69NS-162)
(AD-A050319/3; FAA-ED-21-5) Avail: NTIS HC A08/MF A01 CSCL 05/9

Information to be utilized for program guidance and management direction during the development and implementation phases of the Federal Aviation Administration's Radar Training Facility (RTF) is presented. The RTF is to be installed at the Aeronautical Center as an element of the FAA Academy for academy level radar training and effective evaluation of developmental terminal and en route Air Traffic Control Specialists. Author

N78-23709# Joint Publications Research Service, Arlington, Va.
PRINCIPLES OF ENGINEERING PSYCHOLOGY INVOLVED IN OPTIMIZING CONTROL SYSTEMS OF AIRCRAFT AND SPACECRAFT
V. A. Bodrov and G. M. Zarakovskiy *In its* Space Biol. and Aerospace Med., Vol. 12, No. 2 (JPRS-71096) 11 May 1978 p 7-15 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), v. 12, no. 2, 1978 p 8-14 (For availability see N78-23708 14-51)
Avail: NTIS HC A07/MF A01

N78-23716# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF LOCATION OF INDICATORS ON PSYCHOPHYSIOLOGICAL DISTINCTIONS OF COMBINED ACTIVITY
V. A. Bodrov and Iv Ye. Doroshenko *In its* Space Biol. and Aerospace Med., Vol. 12, No. 2 (JPRS-71096) 11 May 1978 p 52-56 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), v. 12, no. 2 1978 p 42-45 (For availability see N78-23708 14-51)
Avail: NTIS HC A07/MF A01

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N78-23748*# Life Systems, Inc., Cleveland, Ohio.
EVALUATION OF A SPACECRAFT NITROGEN GENERATOR
Final Report
R. D. Marshall, M. K. Lee, and F. H. Schubert Apr. 1978 51 p refs
(Contract NAS2-8732)
(NASA-CR-152097; ER-251-6) Avail: NTIS HC A04/MF A01 CSCL 06K

A research and development program was successfully completed towards the development of a method of generating nitrogen for cabin leakage makeup aboard space vehicles. The

nitrogen generation concept used liquid hydrazine as the stored form of nitrogen. This reduced tankage and expendables weight associated with high pressure gaseous and cryogenic liquid nitrogen storage. The hydrazine was catalytically dissociated to yield a mixture of nitrogen and hydrogen. The latter was separated to provide the makeup nitrogen. The hydrogen will be used in the reduction of metabolic carbon dioxide. Author

N78-23749# Air Force Human Resources Lab., Brooks AFB, Tex.

ANNOTATED BIBLIOGRAPHY OF THE AIR FORCE HUMAN RESOURCES LABORATORY TECHNICAL REPORTS-1976 Final Report

Esther M. Barlow Jan. 1978 53 p
(AF Proj. 9991)
(AD-A051982; AFHRL-TR-78-1) Avail: NTIS HC A04/MF A01 CSCL 05/5

This annotated bibliography presents a listing of technical reports (1976) dealing with personnel and training research conducted by the Air Force Human Resources Laboratory (AFHRL). The research has been conducted by professional personnel representing a variety of disciplines, including psychologists, operations research specialists, mathematicians, computer analysts, economists, electronic engineers, aeronautical engineers, and technical support personnel. AFHRL is charged with the planning and execution of USAF exploratory and advanced development programs for selection, motivation, training, retention, education, assignment, utilization, and career development of military personnel; also the composition of the personnel force and training equipment. This laboratory also provides technical and management assistance to support studies, analyses, development planning activities, acquisition, test evaluation, modification, and operation of aerospace systems and related equipment. Author (GRA)

N78-23750# Royal Aircraft Establishment, Farnborough (England).

THE TRANSMISSION OF VERTICAL VIBRATION TO THE HEADS AND SHOULDERS OF SEATED MEN

G. F. Rowlands May 1977 117 p refs
(RAE-TR-77068; BR59517) Avail: NTIS HC A06/MF A01

An investigation of the frequency response of the human body to vertical vibration, using six subjects on a rigid seat is described. The input used was swept sine acceleration, where the frequency of the vibration varied linearly with time between an upper and lower value at a fixed amplitude. The use of such an input facilitated measurement of amplitude ratio and phase angle plots of the ratio of head and shoulder acceleration to seat acceleration against frequency, to be made for various postures and limb positions was presented. Resting the back against the seat and putting the legs forward were both found to have a major effect on transmission. Attempts are made to model these response curves so that by simply monitoring floor vibration in vehicles and assuming the seat response is known, one can predict the range of vibrations present at the head and shoulders. Theoretical analysis is used to demonstrate that the response of cushions is directly related to the human frequency response. Author (ESA)

N78-23712# Joint Publications Research Service, Arlington, Va.

CONSUMPTION OF FREEZE-DRIED FOOD IN WEIGHTLESSNESS

L. L. Gerdauskene, R. V. Kudrova, N. D. Radchenko, G. N. Savel'yeva, and A. A. Simakov *In its* Space Biol. and Aerospace Med., Vol. 12, No. 2 (JPRS-71096) 11 May 1978 p 29-33 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), v. 12, no. 2, 1978 p 25-28 (For availability see N78-23708 14-51)
Avail: NTIS HC A07/MF A01

N78-23722# Joint Publications Research Service, Arlington, Va.

EXPERIMENTAL SUBSTANTIATION OF MAXIMUM PERMISSIBLE CONCENTRATIONS OF ACETONE AND ACETALDEHYDE IN RECLAIMED POTABLE WATER

N. I. Omel'yanets, N. V. Mironets, N. V. Martyshchenko, I. A. Gubareva, L. F. Piven, and S. N. Starchenko *In its* Space Biol. and Aerospace Med., Vol. 12, No. 2 (JPRS-71096) 11 May 1978 p 87-91 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), v. 12, no. 2, 1978 p 67-70 (For availability see N78-23708 14-51)
Avail: NTIS HC A07/MF A01

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N78-23751*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A DATA ACQUISITION AND HANDLING SYSTEM FOR THE MEASUREMENT OF RADIAL PLASMA TRANSPORT RATES

W. M. Krawczonek, C. E. Boyd (Tex. Univ., Austin), J. Y. Hong (Tex. Univ., Austin), and E. J. Powers (Tex. Univ., Austin) 1977 107 p refs Presented at Symp. on Eng. Aspects of Fusion Res., Knoxville, Tenn., 25-28 Oct 1977
(NASA-TM-78849) Avail: NTIS HC A06/MF A01 CSCL 09B

A system which allows the transfer of experimental data from one or more transient recorders to a digital computer, the entry of calibration data and the entry of archival data is described. The overall approach is discussed and illustrated in detail. Author

N78-23752*# Analytical Mechanics Associates, Inc., Jericho, N.Y.

REQUIREMENTS FOR KALMAN FILTERING ON THE GE-701 WHOLE WORD COMPUTER

S. Pines and S. F. Schmidt Apr. 1978 97 p refs
(Contract NAS1-14311)
(NASA-CR-145346) Avail: NTIS HC A05/MF A01 CSCL 09B

The results of a study to determine scaling, storage, and word length requirements for programming the Kalman filter on the GE-701 Whole Word Computer are reported. Simulation tests are presented which indicate that the Kalman filter, using a square root formulation with process noise added, utilizing MLS, radar altimeters, and airspeed as navigation aids, may be programmed for the GE-701 computer to successfully navigate and control the Boeing B737-100 during landing approach, landing rollout, and turnoff. The report contains flow charts, equations, computer storage, scaling, and word length recommendations for the Kalman filter on the GE-701 Whole Word computer. Author

N78-23753# National Aviation Facilities Experimental Center, Atlantic City, N. J.

COMPARISON TESTING OF AN ANALOG AND DIGITAL RANK-ORDER QUANTIZER Interim Report, Jan. - Jun. 1976

Martin H. Holtz Mar. 1977 88 p ref
(FAA Proj. 142-171-000)
(AD-A038739; FAA-NA-76-36; FAA-RD-76-212) Avail: NTIS HC A05/MF A01 CSCL 09/2

The Radar Processing Subsystem of the All-Digital Tracking Level System was employed to conduct comparative testing of an analog and a digital rank-order quantizer (ROQ). The analog unit was designed to replace an inferior version. The digital ROQ employed an eight but analog to digital converter. The tests were performed for several system configurations, including two modifications to the digital (ROQ). Performance characteristics were based on percent noise regulation, target detection sensitivity, false target rates, isolated hit stability, target hit distribution, and video select mapping. It was concluded that the digital ROQ produced equal to or better system performance, as compared to the analog ROQ provided that the automatic gain control and 50/50 modifications to the digital ROQ were employed. Author

N78-23754# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.

CORE SEARCH

Farley W. Spruell Dec. 1977 36 p refs
(AD-A052065; DRDMI-T-78-37) Avail: NTIS HC A03/MF A01 CSCL 09/2

The Core Search program provides the user with a tabulation of the core storage, number of direct statements and total statements used by each program/subroutine in the weapon control computer software. Author (GRA)

N78-23755# University of Southern Calif., Los Angeles. Dept. of Computer Science.

MICROCOMPUTER EVALUATION

Per Brinch Hansen and Charles Hayden Jan. 1978 62 p
(Contract N00014-77-C-0714)
(AD-A051934) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report evaluates the ability of 16-bit microcomputers to implement a subset of the programming language Concurrent Pascal. The first part of the report describes the most frequency virtual instructions and their implementation; the second part evaluates the process switching time of various microprocessors. Author (GRA)

N78-23756# California Univ., Berkeley. Electronics Research Lab.

RESEARCH ON SOME PROBLEMS IN INFORMATION PROCESSING Final Report, 16 Dec. 1973 - 30 Jun. 1977

Eugene Wong 30 Jun. 1977 4 p
(Grant DAAG29-74-G-0087)
(AD-A051969; ARO-11895.12-EL) Avail: NTIS HC A02/MF A01 CSCL 09/4

The research in this grant was conducted in two principal areas: Stochastic models for image processing; and Management of information and databases. Significant progress was achieved in both areas, and a concise description is included.
Author (GRA)

N78-23757# Naval Underwater Systems Center, New London, Conn. Design Dept.

MEASUREMENTS OF NOISE, SIGNAL, AND SIGNAL-PLUS-NOISE SPECTRA THROUGH A 5-BIT-PLUS-SIGN A/D CONVERTER

John G. DePrimo 5 Jan. 1978 54 p refs
(ARPA Order 2976)
(AD-A051146; NUSC-TR-5769) Avail: NTIS HC A04/MF A01 CSCL 09/5

This report presents the spectra of various quantized input signals obtained by laboratory measurement at the output of a 5-bit-plus-sign analog-to-digital (A/D) converter. The results demonstrate the spectral dynamic range capability for single and multitonal inputs, with and without injected band-limited noise. Optimum input level adjustment, that is, A/D converter biasing, is determined as a function of input signal type. These measurements are verified in theory, wherever possible.
Author (GRA)

N78-23758# Army Armament Research and Development Command, Dover, N. J. Management Information Systems Directorate.

DASF: DESIGN OF ARTWORK FOR STANDARD FORMS Final Report

Joseph J. Sierodzinski Oct. 1977 159 p
(AD-A051426; MISD-UM-77-5) Avail: NTIS HC A08/MF A01 CSCL 09/2

ARRADCOM has developed an interactive computerized system called Design of Artwork for Standard Forms (DASF). It was written to standardize forms design by using today's state-of-the-art graphics technology and equipment. With TEKTRONIX 4014 graphics storage tubes, Control Data series 6000 computers and a CALCOMP model 745 precision flatbed plotter, ARRADCOM is able to create, modify and store from artwork masters in their associated data bases in conversational sessions at a computer terminal. Artwork masters can be produced for local and higher authority Source Data Automation (SDA) systems with ink on paper, ink on mylar or exposed photographic film. These masters may then be used for mass reproduction of the forms. The reproduced forms may be utilized with REDACTOR's (TM), MTST's (TM), standard typewriter stations, and OCR equipment. Author (GRA)

N78-23759# Naval Ocean Systems Center, San Diego, Calif.

MODELS OF OPTIMAL FILE ALLOCATION IN A DISTRIBUTED DATA BASE: A SURVEY. CLASSIFIES DISTRIBUTED FILE ALLOCATION MODELS AND DESCRIBES THE PARAMETERS NEEDED IN MODELING

T. H. Crocker and D. M. Klamer 15 Jan. 1978 30 p refs
(AD-A051142; NOSC/TR-195) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report examines the existing distributed data base file allocation models and gives a breakdown of the models by type (deterministic one-phase, deterministic multi-phase, stochastic discrete, stochastic continuous). The relationships and identities used to describe the models are divided into four categories: file information and parameters, transmission characteristics, computer characteristics, and costs. In the investigations which led to this paper it was seen that the models defined were initially very general. The models included relationships which were very detailed in their description of the file allocation problem. In previous analyses using these models, simplifications were often made for computational tractability. Many of the assumptions and models ended up so restricted in scope or detail as to be unrealistic. There is a great need for more work in this area. Author (GRA)

N78-23760# Oak Ridge National Lab., Tenn. Health and Safety Research Div.

COMPARISON OF SOME NONLINEAR SMOOTHING METHODS

P. R. Bell and R. S. Dillon 1977 9 p refs Presented at 5th Inter. Conf. on Inform. Processing in Med. Imaging, Nashville, 27 Jun. 1977
(Contract W-7405-eng-26)
(CONF-770685-3) Avail: NTIS HC A02/MF A01

Due to the poor quality of many nuclear medicine images, computer-driven smoothing procedures are frequently employed to enhance the diagnostic utility of these images. While linear methods were first tried, it was discovered that nonlinear techniques produced superior smoothing with little detail suppression. Four methods were compared: (1) Gaussian smoothing (linear), (2) two-dimensional least-squares smoothing (linear), (3) two-dimensional least-squares bounding (nonlinear), and (4) two-dimensional median smoothing (nonlinear). The two dimensional least-squares procedures yielded the most satisfactorily enhanced images, with the median smoothers providing quite good images, even in the presence of widely aberrant points.
ERA

N78-23761# California Univ., Livermore. Lawrence Livermore Lab.

DEVELOPMENT OF A MINICOMPUTER SYSTEM FOR ON-LINE PROCESSING OF GAMMA-GAMMA COINCIDENCE EVENTS AND MEASUREMENTS OF E2/M1 MIXING RATIOS IN Cd-110 AND Ba-134 Ph.D. Thesis

Wayne Delmer Ruhter Dec. 1977 168 p refs

(Contract W-7405-eng-48)
(UCRL-52360) Avail: NTIS HC A08/MF A01

A megachannel pulse-height analysis system using a 32,000-word PDP-8/E minicomputer and two moving-head disk memories was developed. The system has a storage capacity of 2 to the 18th power events at any of 2 to the 20th power data locations, is capable of processing 1,040 events/s, and provides on-line sorting and disk storage. An X- or Y- pulse-height spectrum in coincidence with one to four arithmetically combined pulse-height windows can be assembled in core for scope display and spectral analysis within 2 to 20 seconds. The software for the system was written extensively in machine language. Excellent energy and timing resolution were achieved. An energy resolution of 2.3 keV fwhm and a timing resolution of 8.5 ns fwhm were obtained for Co (60) at a singles rate of 10,000 counts/s. Directional correlation data were obtained for gamma-ray cascades in BA (134) and Cd (110). Analyses of these data gave E2/M1 mixing ratios which are in excellent agreement with results obtained by other investigators. ERA

N78-23762# California Univ., Livermore. Lawrence Livermore Lab. Data Management Research Group.
GENERAL FEATURES OF A SCIENTIFIC DATA BASE MANAGEMENT SYSTEM
Viktor E. Hampel and Daniel R. Ries 1977 28 p refs Presented at OECD/NEA Working Group on Nucl. Inform. Berkeley, Calif., 5-7 Oct. 1977 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-807171; Conf-771062-4) Avail: NTIS HC A03/MF A01

Probable causes for the absence of a generalized data base management system as a portable program are discussed as well as some of the following: (1) the difficulty to recognize the value of accurate and up-to-date information and data as a national resource; (2) the gradual evolution of high efficiency specialized installation dependent programs where large volumes of data are present; (3) the historical trend to judge the power of a computer by its calculational speed alone; and (4) the consequent delegation of data management to a piggy-back parasitic role on the large machine. In view of these considerations and on the basis of experience with a diversity of simple and complex information and data, some of the necessary and desirable features for a general scientific data base management system were established. ERA

N78-23763# Technische Universitaet, Brunswick (West Germany). Sonderforschungsbereich 58 - Flugfuehrung.
APPLICATION OF A GRAPHIC COMPUTER SYSTEM WITH IEC BUS FOR COMPUTER-CONTROLLED EXPERIMENTS AND FOR SIMULATION INCLUDING HARDWARE [BEITRAEGE ZUR ANWENDUNG EINES GRAFISCHEN RECHNERSYSTEMS MIT IEC-BUS FUER RECHNERGESTEUERTE EXPERIMENTE UND FUER SIMULATIONEN UND EINSCHLUSS VON HARDWARE-MODELLEN. INTERFERENZSTOERUNGEN BEI LANDESYSTEMEN]
K.-G. Westphal and K.-H. Gloe Jun. 1977 34 p refs In GERMAN
(TUBS/SFB58/59) Avail: NTIS HC A03/MF A01

The development of a procedure for the combination of processes simulated in a computer with simultaneously occurring computer controlled hardware tests with feedback of their results into the simulation was investigated for a graphics Tektronix 4051 computer system connected to a central computer on the one hand and to measuring instruments via an IEC bus, on the other. Information is provided on the program-oriented maintenance of peripheral measuring instruments, and the design of interface devices for complex equipment not compatible with the IEC bus. The instrument landing system is described as an example of such a combined simulation. ESA

N78-23764 National Technical Information Service, Springfield, Va.
INTERACTIVE COMPUTER GRAPHICS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - Jan. 1978
William E. Reed Mar. 1978 156 p Supersedes NTIS/PS-77/0109
(NTIS/PS-78/0223/4) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

Federally-funded studies are cited on hardware and software implementation for interactive graphics systems. The bibliography includes applications in education, electrophysiology, architectural design, structural engineering, transportation systems, chemistry, cartography, dance choreography, aircraft displays, and curve fitting. GRA

N78-23765 National Technical Information Service, Springfield, Va.
INTERACTIVE COMPUTER GRAPHICS, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Feb. 1976 - Jan. 1978
William E. Reed Mar. 1978 239 p Supersedes NTIS/PS-77/0111 and NTIS/PS-76/0078
(NTIS/PS-78/0224/2; NTIS/PS-77/0111; NTIS/PS-76/0078) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

The bibliography cites abstracts from world-wide literature on computer hardware and computer software implementation of interactive graphics systems. Included are applications in circuit design, electrocardiography, transportation systems, cartography, architectural design, structural engineering, education, and curve fitting. GRA

N78-23766# Informatics, Inc., Rockville, Md.
ENVIRONMENTAL PROTECTION AGENCY 1981-1990 ADP REQUIREMENTS STUDY, CONSOLIDATED SYSTEMS STUDY. VOLUME 1: EXECUTIVE MANAGEMENT SUMMARY Final Report
14 Dec. 1977 44 p
(Contract GS-03S-46908)
(PB-276076/7; TR-77-1942-5-Vol-1; EPA-MIDS-11) Avail: NTIS HC A03/MF A01; HC available in set of 7 reports HC E18, PB-276072-SET, and available in set of 3 reports HC E07, PB-276071-SET CSCL 09B

The purpose and objectives of the Environmental Protection Agency (EPA) Automated Data Processing (ADP) planning activities are to obtain the most cost-effective computing/telecommunications resources to meet EPA's computing requirements for the 1981 through 1990 time period. A detailed system study was performed, which identifies the current and projected ADP requirements for the period 1981 through 1900. Each ADP activity is identified using Zero Based Budget (ZBB) decision units and then projected using a multiple scenario approach. GRA

N78-23767# Informatics, Inc., Rockville, Md.
ENVIRONMENTAL PROTECTION AGENCY 1981-1990 ADP REQUIREMENTS STUDY, CONSOLIDATED SYSTEMS STUDY. VOLUME 2: DETAILED REPORT Final Report
14 Dec. 1977 350 p
(Contract GS-03S-46908)
(PB-276077/5; TR-77-1942-6-Vol-2; EPA-MIDS-12) Avail: NTIS HC A15/MF A01; HC also available in set of 7 reports HC E18, PB-276072-SET CSCL 09B

The purpose and objectives of the Environmental Protection Agency (EPA) Automated Data Processing (ADP) planning activities are to obtain the most cost-effective computing/telecommunications resources to meet EPA's computing requirements for the 1981 through 1990 time period. A detailed system study was performed, which identifies the current and projected ADP requirements for the period 1981 through 1990. Each ADP activity is identified using Zero Based Budget (ZBB) decision units and then projected using a multiple scenario approach. GRA

N78-23768# Informatics, Inc., Rockville, Md.
ENVIRONMENTAL PROTECTION AGENCY 1981-1990 ADP REQUIREMENTS STUDY, CONSOLIDATED SYSTEMS STUDY. VOLUME 3: APPENDICES Final Report
14 Dec. 1977 235 p refs
(Contract GS-03S-46908)
(PB-276078/3; TR-77-1942-7-Vol-3; EPA-MIDS-13) Avail: NTIS HC E06/MF A01; HC also available in set of 7 reports HC E18, PB-276072-SET CSCL 09B

The purpose and objectives of the Environmental Protection Agency (EPA) Automated Data Processing (ADP) planning activities are to obtain the most cost-effective computing/

telecommunications resources to meet EPA's computing requirements for the 1981 through 1990 time period. Volumes 1 and 11 of this report presented the results of the Consolidated Systems Study in terms of data and discussions of current and projected workload growth for each EPA organization. The purpose of this volume is to provide the detailed information from which the first two volumes were generated. GRA

N78-23769# Informatics, Inc., Rockville, Md.
ENVIRONMENTAL PROTECTION AGENCY 1981-1990 ADP REQUIREMENTS STUDY, CONSOLIDATED TELECOMMUNICATIONS STUDY. VOLUME 1: EXECUTIVE MANAGEMENT SUMMARY Final Report
14 Dec. 1977 34 p
(Contract GS-03S-46908)
(PB-276073/4; TR-77-1942-8-Vol-1; EPA-MIDS-15) Avail: NTIS HC A03/MF A01; HC also available in set of 7 reports HC E18, PB-276072-SET, and available in set of 3 reports HC E07, PB-276071-SET CSCL 09B

The purpose and objectives of the Environmental Protection Agency (EPA) Automated Data Processing (ADP) planning activities are to obtain the most cost-effective computing/telecommunications resources to meet EPA's computing requirements for the 1981 through 1990 time period. A detailed system study was performed, which identifies the current and projected ADP requirements for the period 1981 through 1990. Each ADP activity is identified using Zero Based Budget decision units and then projected using a multiple scenario approach. GRA

N78-23770# Informatics, Inc., Rockville, Md.
ENVIRONMENTAL PROTECTION AGENCY 1981-1990 ADP REQUIREMENTS STUDY, CONSOLIDATED TELECOMMUNICATIONS STUDY. VOLUME 2: DETAILED REPORT Final Report
14 Dec. 1977 120 p
(Contract GS-03S-46908)
(PB-276074/2; TR-77-1942-9-Vol-2; EPA-MIDS-16) Avail: NTIS HC A06/MF A01; HC also available in set of 7 reports HC E18, PB-276072-SET CSCL 09B

The purpose and objectives of the Environmental Protection Agency (EPA) Automated Data Processing (ADP) planning activities are to obtain the most cost-effective computing/telecommunications resources to meet EPA's computing requirements for the 1981 through 1990 time period. A detailed system study was performed, which identifies the current and projected ADP requirements for the period 1981 through 1990. Each ADP activity is identified using Zero Based Budget decision units and then projected using a multiple scenario approach. GRA

N78-23771# Informatics, Inc., Rockville, Md.
ENVIRONMENTAL PROTECTION AGENCY 1981-1990 ADP REQUIREMENTS STUDY, CONSOLIDATED TELECOMMUNICATION STUDY. VOLUME 3: APPENDICES Final Report
14 Dec. 1977 172 p
(Contract GS-03S-46908)
(PB-276075/9; TR-77-1942-10-Vol-3; EPA-MIDS-17) Avail: NTIS HC E05/MF A01; HC also available in set of 7 reports HC E18, PB-276072-SET CSCL 09B

The purpose and objectives of the Environmental Protection Agency (EPA) Automated Data Processing (ADP) planning activities are to obtain the most cost-effective computing/telecommunications resources to meet EPA's computing requirements for the 1981 through 1990 time period. Volumes 1 and 2 of this report present workloads for telecommunications traffic in support of missions and ADP activity for each geographic location in EPA. Current and projected workload is defined for ADP users in terms of average number of characters transmitted per month to and from Washington Computer Center (WCC) and National Computer Center (NCC) computing facilities. The purpose of this volume is to provide the detailed information from which the first two volumes were generated. Author

N78-23772# !nformatics, Inc., Rockville, Md.
ENVIRONMENTAL PROTECTION AGENCY 1981-1990 ADP REQUIREMENTS STUDY. CONVERSION STUDY: TECHNICAL REPORT Final Report
14 Dec. 1977 123 p
(Contract GS-03S-46908)
(PB-276079/2; TR-77-1942-11; EPA-MIDS-19) Avail: NTIS HC A06/MF A01: HC also available in set of 7 reports HC E18, PB-276072-SET,and available in set of 3 reports HC E07, PB-276071-SET CSCL 09B

The Conversion Study Report represents the impact upon EPA of converting existing ADP activities operated at the IBM and UNIVAC facilities to upgraded hardware of either the same type or other types. In addition, it identifies the specific information which must be made available to the system design contractors in order to determine the total cost of their alternative design concepts. This document, in conjunction with the Consolidated System Study and the Consolidated Telecommunications Study, represent the EPA statement of needs for the current and future time periods. The contents of this document address the following: identification of conversion workload factors; application of these factors to current systems; planned or developmental systems for operation prior to conversion; projected conversion workload and costs based on 1981 workload values, as projected by the Consolidated System Study; planning considerations for the conversion process. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N78-23773 North Carolina Univ., Chapel Hill.
HIGH LEVEL DATA FLOW ANALYSIS USING A PARSE TREE REPRESENTATION OF THE PROGRAM Ph.D. Thesis
Wayne Allen Babich 1977 96 p
Avail: Univ. Microfilms Order No. 78-07112

An iterative technique, called the method of attributes, was developed for performing global data flow analysis using a parse tree representation of the source program. The technique was based on a variant of attribute grammars, and permits most control flow structures found in modern algorithmic languages, including unconstrained GOTO's. It was applied to analysis of live variables and to analysis of available expressions; in both cases, time required for analysis of GOTO-less programs was linear in program size (with a small constant of linearity), regardless of the nesting depth of program loops. The importance of producing data flow analysis information, on demand, is also discussed. The demand problem is the problem of supplying a single piece of data flow information upon request from an optimizer or other processor. The method of attributes was applied to demand analysis of live variables. Dissert. Abstr.

N78-23774 Carnegie-Mellon Univ., Pittsburgh, Pa.
PROGRAM STRUCTURES FOR EXCEPTIONAL CONDITION HANDLING Ph.D. Thesis
Roy Levin 1977 193 p
Avail: Univ. Microfilms Order No. 78-04937

A language-independent program structuring tool that permits uniform processing of exceptional conditions at many levels in a programming system hierarchy, particularly including levels within the operating system(s), was defined. The proposed mechanism solves a collection of practical exception handling problems that arise frequently in large systems, and it does so in a way that is amenable to rigorous automatic verification. Specially, the mechanism copes naturally with parallelism and shared data structures, two common elements of complex programs that are beyond the scope of existing or previously proposed exception handling constructs. Dissert. Abstr.

N78-23775 Cornell Univ., Ithaca, N. Y.
FORMAL SEMANTIC DESCRIPTIONS OF APPLICATIVE LANGUAGES Ph.D. Thesis
Gerald Alan Jones 1977 150 p
Avail: Univ. Microfilms Order No. 7806302

Complementary denotational and axiomatic semantic descriptions for certain applicative programming languages are presented. The simplest language considered, employs no variables and possesses a very straightforward denotational definition, yet has

the power to express any computable function and contains several high-level language constructs. This language is extended to include variables, assignments, and user-defined functions with parameters called by value. These extensions, however, are formulated in such a way that the applicative design of the language is retained. Axiomatic semantic descriptions are given for these languages, and the axioms and inference rules are shown to be consistent and complete (in a special sense) with respect to the denotational definitions of the languages.
Dissert. Abstr.

N78-23776 Johns Hopkins Univ., Baltimore, Md.
GENERIC CHARACTERIZATIONS OF MULTIPLE FAULTS FOR TABLE-LOOK-UP COVERAGE BOUNDING IN TREE NETWORKS Ph.D. Thesis
Vinod Kumar Agarwal 1978 220 p
Avail: Univ. Microfilms Order No. 7806231

A fundamental concept involving the testing of a multiple fault by an input vector due to its coverage of a single fault is developed as the basis for the study. Using this concept, and by introducing two fault relationships, testing direction and consistency, it is shown that given a set, denoted as, day, K. Absolute K = v greater than or = to 1, of lines in a network, the greatest lower bound on the capability of single fault detection test sets (SFDTD) to cover the 2 superscript v simultaneous, multiple faults on K can be obtained simply by knowing the logical interconnection of the lines of K in the network. The concept of an L-expression is next developed to generically represent the logical interconnection of any given set of lines in a network, where an L-expression is simply a combination of a given number of L symbols interconnected by + and sub v operators. This abstraction in terms of L-expressions permits the generation of a table, referred to as the Coverage Table, wherein corresponding to each L-expression, denoted as L sub, an integer, denoted as B(L sub v), is associated. Dissert. Abstr.

N78-23777 Auburn Univ., Ala.
A LANGUAGE FOR BOOLEAN FUNCTION REPRESENTATION AND MANIPULATION Ph.D. Thesis
long Chen 1977 260 p
Avail: Univ. Microfilms Order No. 7806078

Computerized processing of Boolean functions can significantly extend the range of problems that can be solved using Boolean algebra. A language ABAL (Auburn Boolean Algebra Language) and its compiler were designed and implemented on PDP 11/40 RSTS/E System. Boolean functions, either in algebraic form, or minterm/maxterm and don't care list form may be represented in the language. Operations, such as assignment of logical value, functional form changes, application of simplification rules, generation of truth tables, generation of minterm or maxterm lists, generation of prime implicants or prime implicates, minimization of functions, and functional combinations using Boolean operators are available in the language. The ABAL compiler is written in BASIC-PLUS for use in a DEC PDP 11/40 RSTS/E system. Dissert. Abstr.

N78-23778 Arizona Univ., Tucson.
INCREMENTAL SYNTHESIS OF INDUCTIVE ASSERTIONS FOR PROGRAM VERIFICATION Ph.D. Thesis
Dianne Ellen Britton 1977 196 p
Avail: Univ. Microfilms Order No. 78-04894

A severe drawback to using the method of inductive assertions to verify programs is the difficulty of discovering the necessary inductive assertions. Empirical observation shows, however, that the inductive assertions required to verify a program are usually conjunctions of individual loop invariants. This dissertation shows how each of these loop invariants can be actively sought by considering some constraints on the inductive assertion. An incremental approach to verification is described which permits inductive assertions to be developed step-by-step by finding the individual loop invariants one at a time and which effectively partitions a program's proof of correctness into a number of smaller, simpler proofs. A simple Algol-like programming language L is defined, which supports incremental verification. An algorithm for incrementally verifying programs in L is given.
Dissert. Abstr.

N78-23779# Stanford Univ., Calif. Digital Systems Lab.
EMULATION ORIENTED SOFTWARE FIRST DEVELOPMENT
Lee W. Hoevel and Walter A. Wallach Aug. 1976 18 p refs
(Grant DAAG29-76-G-0001)
(AD-A051835; SU-DSL-TN-95; ARO-12958.9-M) Avail: NTIS HC A02/MF A01 CSCL 09/2

Software First is the design philosophy whereby applications software is developed to solve specific problems prior to the availability of applications hardware. One proposes the use of an interpretive computing facility, designed around a high performance microprogrammable host machine, to support and enhance Software First in the following manner: Applications programs are initially converted into a high-level intermediate text (DEL) by a straightforward one-plus pass compiler. The intermediate text so generated is executed interactively via a microcoded interpreter. This assures that diagnostics can be generated at the source level (e.g., dumpless debugging), and allows the exploitation of the host machine's inherent capabilities to attain speedy interactive response; and the intermediate text surrogates for applications programs, having been verified by interactive debugging, are then processed by a simple generator to produce an applications-hardware compatible code. This hard code is then checked out on the development system by redefining the microcode running in the host machine so that it becomes an image of the projected applications hardware. GRA

N78-23780# Stanford Univ., Calif. Digital Systems Lab.
DELTRAN PRINCIPLES OF OPERATION: A DIRECTLY EXECUTED LANGUAGE FOR FORTRAN-2
Lee W. Hoevel Mar. 1977 29 p refs
(Grant DAAG29-76-G-0001)
(AD-A051448; SU-DSL-TN-108; ARO-12958.3-M) Avail: NTIS HC A03/MF A01 CSCL 09/2

This paper describes a novel directly executed language (DELtran) tailored specifically to the FORTRAN source language, EMMY host, and scientific programming. DELtran is 'transformationally complete' in that; (1) Code generation is linear with respect to the number of operators in a FORTRAN program, (2) Only k DELtran instruction units are needed to represent a FORTRAN statement containing k functional operators, (3) The space needed to represent a FORTRAN statement approaches N*v-F*k -- where v is the number of distinct variables in the statement, and N and F are the least integers such that there are less than 2**N distinct variables and 2**F distinct operators in the relevant scope of definition. In addition, DELtran is 'transparent' in that there is a 1-1 correspondence between DELtran operators and control constructs and FORTRAN operators and control constructs, and 'invertible' in that all sensible sequences of DELtran instruction units have a direct FORTRAN analogue. Author (GRA)

N78-23781# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
SPECIFICATION AND VERIFICATION TECHNIQUES FOR PARALLEL PROGRAMS BASED ON MESSAGE PASSING SEMANTICS Ph.D. Thesis
Akinori Yonezawa Dec. 1977 225 p refs
(Contract N00014-75-C-0522)
(AD-A051149; MIT/LCS/TR-191) Avail: NTIS HC A10/MF A01 CSCL 09/2

This thesis presents formal specification and verification techniques for both serial and parallel programs written in SIMULA-like object oriented languages. These techniques are based on the notion of states of individual objects which are defined uniformly in serial and parallel computations. They can specify and verify the behavior of data and procedural objects in multi-process environments, thus overcoming some of the difficulties in dealing with parallelism which characterized previous work on formal specifications for abstract data types. Among others, the specifications and verifications of a bounded buffer and air line reservation systems are given. Using a model of a simple post office illustrates our specification and verification techniques for systems, such as operating systems and multi-user data base systems, which are characterized by complex internal concurrent activities. It is demonstrated that the specifications of the overall functions of the system which are called task specifications can be derived from specifications of the individual

behavior and mutual interaction of the subsystems. A method of defining states of individual objects as mathematical functions is suggested. GRA

N78-23782# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

WUSOR 2: A COMPUTER AIDED INSTRUCTION PROGRAM WITH STUDENT MODELLING CAPABILITIES M.S. Thesis

Brian Patrick Bowen Carr Jun. 1977 125 p refs

(Contract N00014-75-C-0643)

(AD-A051255; AI-M-417; LOGO-M-45) Avail: NTIS HC A06/MF A01 CSCL 05/9

Wusor 2 is the second program that has been developed to tutor students in the game of Wumpus. From the earlier efforts with Wusor I it was possible to produce a rule-based expert which possessed a relatively complete mastery of the game. Wusor endeavors to teach the knowledge embodied in the rules used by the expert. The student model represents Wusor's estimation of the student's knowledge of said rules, and this estimation is based primarily on analyses of the player's moves. The student model allows Wusor to personalize his explanations to the student according to the student's current knowledge of the game. The result is a system which, according to preliminary results, is highly effective at tutoring students of varied abilities. Author (GRA)

N78-23783# General Electric Co., Arlington, Va.

PREDICTING SOFTWARE COMPREHENSIBILITY

S. B. Sheppard, M. A. Borst, and L. T. Love Feb. 1978 71 p refs

(Contract N00014-77-C-0158)

(AD-A051495; TR-78-388100-2) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report describes the first experiment in a program of research designed to identify characteristics of computer software which are related to its psychological complexity. This experiment evaluated the effect of three independent variables (mnemonic variable names, complexity of control flow, and general type of program) on a programmer's understanding of a computer program. The contributions of several variables, including Halstead's software science metric and McCabe's complexity metric, to the prediction of program understanding were also evaluated. In a pilot study significant results were achieved with materials and procedures employed here. Thirty-six experienced programmers were instructed to study a computer program for 20 minutes, and were then given 25 minutes to reconstruct a functionally equivalent one. Performance was measured by the percentage of functionally correct statements recalled. Results indicated that complexity of control flow affected program understanding, while no relationship was found for mnemonic variable names and general program type. The metrics of both Halstead and McCabe were related to program understanding when differences between subjects and specific programs were taken into consideration. GRA

N78-23784# Argonne National Lab., Ill.

LINPACK WORKING NOTE NO. 9: PRELIMINARY LINPACK USER'S GUIDE

J. J. Dongarra, J. R. Bunch, C. B. Moler, and G. W. Stewart Aug. 1977 216 p refs

(Contract W-31-109-eng-38)

(ANL-AMD-TM-313) Avail: NTIS HC A10/MF A01

The computer program LINPACK, is a collection of FORTRAN programs for solving various types of linear systems. The package is concerned with general, banded, symmetric indefinite, symmetric positive definite, triangular and tridiagonal square matrices, as well as with least-squares problems and the QR and singular value decompositions of rectangular matrices. The routines are designed to be completely machine independent, fully portable, and to run at near optimum efficiency in most operating environments. ERA

N78-23785# New York Univ., N. Y. Courant Inst. of Mathematical Sciences.

CORRECT-PROGRAM TECHNOLOGY/EXTENSIBILITY OF VERIFIERS: TWO PAPERS ON PROGRAM VERIFICATION

Martin Davis, J. T. Schwartz, and E. Deak Sep. 1977 150 p refs

(Contract EY-76-C-02-3077; Grants NSF MCS-76-24212; NSF MCS-71-02039; NSF MCS-76-00116)

(NSO-12) Avail: NTIS HC A07/MF A01

The problem of finding formal techniques for proving program correctness is addressed. Programming language, proof formalism and proof rules, and code transformation rules are considered. The method is illustrated by proving the correctness of a simple, high-level algorithm, the root form of which is initially described by a succinct, very high level text, which is then manipulated systematically and converted by stages into a correct assembly-language version of the same algorithm. A system for verifying programs is discussed. It must not accept a statement as correct unless a proof of it is accepted by the system. A logical prototype is presented of such a system. A description is given of the way in which it could accept general notational extensions of its initial proof formalism. Some of the logical issues that arise in connection with the computerization of such systems are touched on and some of the metamathematical questions raised by the method used to achieve extensibility are analyzed. ERA

N78-23786# International Institute for Applied Systems Analysis, Laxenburg (Austria).

DYNAMIC LINEAR PROGRAMMING MODEL FOR AGRICULTURAL INVESTMENT AND RESOURCES UTILIZATION POLICIES

C. Csaki Sep. 1977 35 p refs

(IIASA-RM-77-36) Avail: NTIS HC A03/MF A01

A dynamic linear programming model for large scale farm development is presented. Special emphasis is placed upon the modeling of investment policies and associated resource utilization programs. First, a flexible modeling procedure to handle capital input constraints of farms is outlined. The method is discussed within the framework of a traditional linear programming model and a numerical example is also given showing how this procedure can be used to formulate models of farm development for decision making purposes. Second, a dynamic linear programming model covering the whole farming system and the whole planning horizon is described. It is evolved from the static model introduced previously, optimizing both production mix and resource utilization. Besides the description of crop and animal production, as well as resource utilization subsystems, the model includes a very detailed financial subsystem. Finally, the experiences gained in Hungary in the use of different linear and dynamic linear programming models of agricultural development are summarized. Author (ESA)

N78-23787# International Institute for Applied Systems Analysis, Laxenburg (Austria).

PLANNING LONG RANGE AGRICULTURAL INVESTMENT PROJECTS: A DYNAMIC LINEAR PROGRAMMING APPROACH

H. Carter, C. Csaki, and A. Propoi Jul. 1977 36 p refs

(IIASA-RM-77-38) Avail: NTIS HC A03/MF A01

A dynamic linear programming (DLP) model for planning a diversified agri-industrial complex is described. Six production subsystems are presented: livestock, crops, primary product utilization, processing, inputs, and resource capacities. In addition, a financial subsystem is described. The final two sections discuss briefly alternative goal functions and some limitations of the DLP model for investment planning. Author (ESA)

N78-23788# Royal Netherlands Meteorological Inst., De Bilt.

DESCRIPTION OF AUTOMATIC PLOTTING COMPUTER PROGRAMS [BESCHRIJVING VAN HET PROGRAMMAPAKKET T.B.V. HET AUTOMATISCH PLOTTEN]

G. D. G. Folkers 1977 28 p refs In DUTCH

(KNMI-V-292) Avail: NTIS HC A03/MF A01

Automatic plotting programs for wave maps, detail maps, rain maps, aerology, and aerology/temps are described. The programs are written in Burroughs Extended ALGOL (BEA) for use on a Burroughs B6700 computer. The output consists of plotfiles stored on disks using the Xynetics basic software package. The plotfiles can be used on a Xynetics plotter. The program package being quite large, the listings have not been printed in the document. ESA

N78-23789# National Physical Lab., Teddington (England). Div. of Chemical Standards.
THE CONSTRAINED FITTING OF VAPOUR PRESSURES
C. P. Hicks Jan. 1978 35 p refs
(NPL-Chem-77) Avail: NTIS HC A03/MF A01

The numerical analysis and programming required to carry out the fitting of limited vapor pressure data while imposing constraints on some derived properties are discussed, and illustrated by work on the fitting of an equation proposed by Wagner. The problem of determining the coefficients of a vapor pressure equation from a few data points is frequently encountered. Flexibility of form in such equations, desirable when fitting good and comprehensive data, can be a hazard in such circumstances leading to unrealistic predictions of derived properties (e.g. heats of vaporization). Author (ESA)

N78-23790# Royal Aircraft Establishment, Farnborough (England).
MIRANDA DATA PROCESSING-PROGRAMS
E. U. Trevorrow and J. I. Thomas May 1977 43 p refs
(RAE-TR-77071; BR59168) Avail: NTIS HC A03/MF A01

Miranda was a low-orbit technology satellite carrying a number of experimental packages. A comprehensive software system was developed for its operational support and the processing of experimental data. The various categories of data processing employed are outlined and each program that was provided described. Author (ESA)

N78-23791# Royal Radar Establishment, Malvern (England).
INTRODUCTION TO THE RS PORTABLE COMPILER
S. G. Bond and P. M. Woodward Aug. 1977 31 p refs
(RRE-TN-802; BR59078) Avail: NTIS HC A03/MF A01

The portable compiler for ALGOL 68 developed at RSRE by Currie and Morison is described. The language extensions handled by the compiler, and the system of modular compilation, as seen by the user are defined. The structure of a complete system is outlined emphasizing the design of the intermediate language produced by the compiler for input to a machine-dependent translator. Author (ESA)

N78-23792# National Physical Lab., Teddington (England).
A PROGRAM TO CALCULATE THE GAMM MEASURE
B. A. Wichmann and J. DuCroz Dec. 1977 22 p refs
(NPL-NAC-86) Avail: NTIS HC A02/MF A01

A FORTRAN program the execution time of which is proportional to the GAMM measure of computer performance is presented. An error analysis of the floating point calculation in the program is presented. This analysis permits the program to be used as a confidence check on the accuracy of the floating point facilities of the computer. The GAMM measure of performance is often quoted by manufacturers, mainly in Europe, to indicate the speed of a machine on scientific calculations. The measure is a weighted average of the time taken in five simple numerical loops. Author (ESA)

N78-23793# International Institute for Applied Systems Analysis, Laxenburg (Austria).
THE DYNAMIC SIMPLEX-METHOD
A. I. Propoi (Inst. for Systems Studies, Moscow) and V. E. Krivonozhko (Inst. for Systems Studies, Moscow) Jun. 1977 76 p refs
(IIASA-RM-77-24) Avail: NTIS HC A05/MF A01

Finite-step method for solving Dynamic Linear Programming (DLP) problems is described. Many optimization problems in economic, management, technology, etc. are formulated as DLP problems, because now it becomes difficult to make a decision without taking into account the possible consequences of such a decision for a certain time period. As DLP problems are large-scale by nature, the standard 'static' LP methods become ineffective for the dynamic case and the development of methods specially oriented to DLP problems is needed. The method suggested is a natural and straightforward extension of one of the most effective static LP methods - the simplex method - for DLP. A new concept - a set of local bases - (for each time step) is introduced, thus enabling considerable reduction of the requirements to computer core memory and CPU time. In the proposed method the system of T local m x m bases is introduced and the basic simplex procedures (selection of vectors to be removed from and to be introduced into the basis, pricing procedure, transformation of bases) as applied to this system of T local bases are described. Evaluation of possibilities of the method and its connection with compact inverse LP method are discussed. Author (ESA)

62 COMPUTER SYSTEMS

Includes computer networks.

N78-23794 California Univ., Los Angeles.
SWITCHING AND FLOW CONTROL TECHNIQUES IN COMPUTER COMMUNICATION NETWORKS Ph.D. Thesis
Parviz Kermani 1977 347 p
Avail: Univ. Microfilms Order No. 78-06500

A new switching technique, virtual-cut-through, was proposed and its performance was analyzed. Through the comparative study of different switching schemes (virtual-cut-through, message (or packet) switching, and circuit switching), certain ground rules were established which aid the network designer in deciding which switching method to use in a data communication network. Flow control procedures for computer networks were investigated and analytic models for the window mechanism were developed. In static flow control, parameters of the system are not adjusted to the stochastic load fluctuations. In dynamic flow control, parameters of the system are dynamically adjusted to the resource availability of the network. Based on Markov decision theory, an optimal policy to dynamically decide on the window size was formulated. Dissert. Abstr.

N78-23795 Iowa State Univ. of Science and Technology, Ames.
ANALYSIS OF NONLINEAR RESISTIVE NETWORKS HAVING MULTIPLE SOLUTIONS WITH SPLINE FUNCTION TECHNIQUES Ph.D. Thesis
Hao-Chang Wu 1977 94 p
Avail: Univ. Microfilms Order No. 7805978

A technique, called piecewise-cubic spline method was developed for analyzing nonlinear resistive networks with multiple solutions, particularly circuits with elements that are characterized by complicated unicursal curves. The v-i characteristic of the nonlinear resistor was interpolated by smooth piecewise-cubic functions instead of piecewise-linear functions. The method of using piecewise-cubic spline approximations has its main advantage over other techniques when the nonlinear element itself has relatively sharp bends in its v-i curve. Spline functions allow the condition of continuous first and/or second derivatives at the knots, or junction of succeeding spline segments. Eight examples are presented. All involve tunnel diode circuits. In these, results were compared with analyses by other methods.
Dissert. Abstr.

N78-23796*# Stanford Univ., Calif. Digital Systems Lab.
CRITICAL FAULT PATTERNS DETERMINATION IN FAULT-TOLERANT COMPUTER SYSTEMS Final Report, 1 Apr. - 30 Sep. 1977
E. J. McCluskey and J. Losq Jan. 1978 82 p
(Grant NsG-1410; SEL Proj. 24-77)
(NASA-CR-145352) Avail: NTIS HC A05/MF A01 CSCL 09B

The method proposed tries to enumerate all the critical fault-patterns (successive occurrences of failures) without analyzing every single possible fault. The conditions for the system to be operating in a given mode can be expressed in terms of the static states. Thus, one can find all the system states that correspond to a given critical mode of operation. The next step consists in analyzing the fault-detection mechanisms, the diagnosis algorithm and the process of switch control. From them, one can find all the possible system configurations that can result from a failure occurrence. Thus, one can list all the characteristics, with respect to detection, diagnosis, and switch control, that failures must have to constitute critical fault-patterns. Such an enumeration of the critical fault-patterns can be directly used to evaluate the overall system tolerance to failures. Present research is focused on how to efficiently make use of these system-level characteristics to enumerate all the failures that verify these characteristics. Author

N78-23797# Argonne National Lab., Ill.
DESIGN AND IMPLEMENTATION OF A LOCAL COMPUTER NETWORK
P. J. Fortune, W. P. Lidinsky, and B. R. Zelle 1977 7 p refs Presented at IEEE Conf. Chicago, Jun. 1977
(Contract W-7405-eng-38)
(CONF-7706104-1) Avail: NTIS HC A02/MF A01

An intralaboratory computer communications network was designed and is being implemented at Argonne National Laboratory. Parameters which were considered to be important in the network design are discussed; and the network, including its hardware and software components, is described. A discussion of the relationship between computer networks and distributed processing systems is also presented. The problems which the network is designed to solve and the consequent network structure represent considerations which are of general interest. ERA

N78-23798# Gardner Research Co., Palo Alto, Calif.
CLOCK AND CARRIER SYNCHRONISATION: PREFILTER AND ANTIHANG-UP INVESTIGATIONS
Floyd M. Gardner Paris ESA Nov. 1977 146 p refs
(Contract ESA-2582/75)
(ESA-CR-984) Avail: NTIS HC A07/MF A01

Two problems in carrier and clock synchronization for TDMA systems are dealt with: clock prefilters and the phase locked loop hangup. Theoretical predictions of the ability of a prefilter to eliminate pattern jitter in a linear system were verified by computer simulation. In a nonlinear channel, the improvement is far less dramatic; this is ascribed to intersymbol intermodulation, which cannot be eliminated by a linear filter. Other techniques can provide performance improvements in the nonlinear channel, which are similar to those due to a prefilter; therefore, a prefilter is not regarded as an essential element in the synchronizer. In an earlier study, phase-locked synchronizers were rejected in favor of tuned filters because of phase-hang-up problems. Practical implementations of tune-filter synchronizers have, however, revealed a need for costly and complex AFC circuits, which are not required with phase-locked synchronizers. The phenomenon of hang-up is therefore examined carefully, and it is concluded that there are two causes: small equilibrium-restoring force and equivocation about decision boundaries. Techniques for preventing hang-up are proposed. Analyses of starting procedures and implementation of nonlinear regenerators and auxiliary phase detectors are included. Author (ESA)

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N78-23799# California Univ., Los Angeles. Dept. of System Science.
THREE-DIMENSIONAL GEOMETRIC MOMENT SPACE BOUNDS WITH APPLICATIONS TO PROBLEMS IN COMMUNICATION THEORY
M. A. King, Jr. and K. Yao Feb. 1978 88 p refs
(Contract N00014-76-C-0875)
(AD-A052142; UCLA-ENG-7805) Avail: NTIS HC A05/MF A01 CSCL 09/4

The solution to many problems in communication theory takes the form of a moment of a function of a random variable. Often this moment is difficult to evaluate numerically. When this is the case, tight bounds to the true value are sought that are relatively easy to evaluate. One method of deriving such bounds is a geometrical technique that is a result of an Isomorphism Theorem from Game Theory. Recently very useful bounds have been derived with this technique using two-dimensional geometries. This report extends this work into a useful class of three-dimensional geometries. This class of geometrices can produce very tight bounds with a reasonable amount of effort. Author (GRA)

N78-23800# California Univ., Berkeley. Dept. of Electrical Engineering and Computer Sciences.
ROBUSTNESS OF STABILITY CONDITIONS FOR LINEAR TIME-INVARIANT FEEDBACK SYSTEMS Interim Report
C. A. Desoer, F. M. Callier (Namur Univ., Belgium), and W. S. Chan 1977 8 p refs
(Contract F44620-71-C-0087; Grant NSF ENG-74-06651)
(AD-A051989; AFOSR-78-0406TR) Avail: NTIS HC A02/MF A01 CSCL 09/3

The robustness of stability conditions for linear time-invariant feedback systems is examined assuming three different types of representations: state-space representation, coprime matrix fraction representation, and transfer function representation. The importance is stressed of certain details of the representation used and, even more, the importance of making sure that the allowed perturbations be relevant to the physical situation under study. GRA

N78-23801# Rice Univ., Houston, Tex. Aero-Astronautics Group.
SEQUENTIAL CONJUGATE GRADIENT-RESTORATION ALGORITHM FOR OPTIMAL CONTROL PROBLEMS WITH NONDIFFERENTIAL CONSTRAINTS. PART 2: EXAMPLES Interim Report
J. R. Cloutier, B. P. Mohanty, and A. Miele 1977 130 p refs
(Grant AF-AFOSR-3075-76; AF Proj. 2304)
(AD-A051103; AAR-127-Pt-2; AFOSR-78-0327TR) Avail: NTIS HC A07/MF A01 CSCL 12/1

In the first volume the sequential conjugate gradient-restoration alogorithm was developed for minimizing a functional subject to differential constraint, nondifferential constraints, and terminal constraints. In this report, sixteen numerical examples are presented, four pertaining to a quadratic functional subject to linear constraints and twelve pertaining to a nonquadratic functional subject to nonlinear constraints. These examples demonstrate the feasibility as well as the rapid convergence characteristics of the sequential conjugate gradient-restoration algorithm. GRA

N78-23802# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
PERFECT SPLINES AND NONLINEAR OPTIMAL CONTROL THEORY
Gunnar Aronsson 1977 18 p refs
(CTH-Math-1977-11) Avail: NTIS HC A02/MF A01

A method derived from the nonlinear optimal theory was used to establish perfect spline properties of a solution to a given extremum problem, i.e., to minimize the L norm of a nonlinear expression over all sufficiently smooth functions of time that satisfy given boundary conditions. It is shown that under suitable assumptions there exists a solution such that the nonlinear expression becomes constant, independent of time, and that the n-th order derivatives of the solution are piece-wise continuous with a finite number of jump discontinuities. ESA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N78-23803 Tufts Univ., Medford, Mass.
STRUCTURAL STABILITY OF COMPLETELY UNSTABLE FLOWS IN THE PLANE Ph.D. Thesis
John Frederick Collins 1977 130 p
Avail: Univ. Microfilms Order No. 78-03889

Although there is a good structural stability theory for flows on compact manifolds, there are very few results which apply to noncompact manifolds. The compact theory makes essential use of the compactness; for instance, the existence of stable manifolds for hyperbolic sets is now known in the non-compact case. Completely unstable flows, i.e., those with no non-wandering points, are restricted to non-compact manifolds. Consideration was given to completely unstable (or equivalently non-critical) flows in the plane which satisfies the following property: Every point, x, has a neighborhood which contains no prolongational limits except possibly points on the orbit of x. The main result is that such a flow is structurally stable if and only if no point

is both a positive, and a negative prolongational limit.
Dissert. Abstr.

N78-23804 Illinois Univ., Urbana-Champaign.
FINITE ELEMENT SOLUTIONS OF ELLIPTIC SYSTEMS OF PARTIAL DIFFERENTIAL EQUATIONS AND THE ISOPARAMETRIC TECHNIQUE Ph.D. Thesis
Brian Merrick OConnor 1977 113 p
Avail: Univ. Microfilms Order No. 78-04103

The finite element method is applied to a minimization problem that corresponds to a system of second order, linear partial, differential equations with homogeneous boundary conditions. Node requirements and nodal placement are discussed, and a generalization is included. The isoparametric technique is discussed. Piecewise quadratic transformations are considered. These quadratic transformations are then considered in greater detail. It is demonstrated that a quadratic change of coordinates can straighten parabolic cylinders, virtually every curvilinear tetrahedron with three planar faces and a curved face which is part of a parabolic cylinder is suitable for use in the isoparametric technique. Dissert. Abstr.

N78-23805 Missouri Univ., Columbia.
NUMERICAL METHODS FOR TIME OPTIMAL CONTROL OF LINEAR SYSTEMS WITH APPLICATIONS TO NEUTRAL SYSTEMS Ph.D. Thesis
William Carl Pickel 1977 159 p
Avail: Univ. Microfilms Order No. 78-03758

Four classes of controlled processes are introduced for linear control systems with a pure time delay in the controller. Conditions are presented for ascertaining whether the domain of null controllability is, in fact, the whole state space for each type of process. A means of determining whether the global conditions hold, based on the system equations, is presented for some special processes using scalar controllers. A synthesis procedure is provided for the numerical solution of the time optimal control problems associated with the four classes of controlled processes. Algorithms, effecting this synthesis are given and applied to solved examples. Analytical solutions of the time optimal control problem for four examples of a time optimal control problem involving a linear neutral system are solved. Dissert. Abstr.

N78-23806 Arizona State Univ., Tempe.
TIME SERIES ANALYSIS AND FORECASTING IN AN UNSTABLE ENVIRONMENT Ph.D. Thesis
Joseph C. H. Smith 1977 311 p
Avail: Univ. Microfilms Order No. 78-05398

This research formulated a time series model which allows for certain types of environmental instability, and developed estimation and forecasting methodology for the formulated model. The model breaks the time series into a deterministic part and a stochastic part. The deterministic part is allowed to shift when the environment changes, while the stochastic part is assumed to be a stationary autoregressive moving average (ARMA) process. Several examples are given which demonstrate the superiority of the model developed in this research. Dissert. Abstr.

N78-23807 Maryland Univ., College Park.
COMPUTER SOLUTION OF LARGE DENSE LINEAR PROBLEMS Ph.D. Thesis
Eric Myrn Hill 1977 228 p
Avail: Univ. Microfilms Order No. 7805029

The solution of matrix problems on a paged computer system was studied. The first problem was that of solving the linear system A x = b, where b and x are real n vectors and A is a real matrix of order n. The second problem was that of finding the eigenvalues of a real n x n matrix. A general column oriented elimination strategy, called the right to left concurrent (RLC) algorithm, for reducing matrices to upper triangular form was developed. The solution of the eigenvalue problem involves two major steps: the reduction of the matrix to Hessenberg form and the application of the QR algorithm to find the eigenvalues of the Hessenberg matrix. Three different column oriented algorithms for reducing a matrix to Hessenberg form are presented and compared. Dissert. Abstr.

N78-23808 Maryland Univ., College Park.
A CONCEPT OF BERNOULLI NUMBERS IN ALGEBRAIC FUNCTION FIELDS Ph.D. Thesis
William Merritt Snyder, Jr. 1977 130 p
Avail: Univ. Microfilms Order No. 78-05035

A concept was defined for Bernoulli numbers in an abstract algebraic function field of one variable with characteristic zero, with respect to an abstract differential. Using properties of suitably generalized Hurwitz series, a von Staudt-Clausen decomposition theorem was obtained which included an invariance phenomenon that answered the question above as a special case. It was found that the coefficients of the Weierstra and Hessian elliptic functions were a special case of the abstract Bernoulli numbers in an elliptic function field with respect to a differential of the first kind. Although the methods of Hurwitz-Carlitz-Moreno and Herglotz-Niemeyer were different, their results coincided. An attempt was made to obtain some results on Kummer congruences for these abstract Bernoulli numbers. Dissert. Abstr.

N78-23809 California Inst. of Tech., Pasadena.
ARITHMETICAL PROPERTIES OF COMBINATORIAL MATRICES Ph.D. Thesis
Eric Paul Verheiden, Jr. 1978 48 p
Avail. Univ. Microfilms Order No. 7805698

Three types of matrix completion problems, integral matrices partial Hadamard matrices and partial incidence matrices of symmetric block designs were studied. It was found that rational normal completing matrices in which all denominators are powers of two are always possible in the first two cases and almost always possible in the final case. Using a computer approach, it was shown that the last seven rows of a partial Hadamard matrix or a partial incidence matrix (with suitable parameters) can always be completed. An appendix lists the computer tabulation which is the basis of this conclusion.
Dissert. Abstr.

N78-23810 Bowling Green State Univ., Ohio.
ORDERABLE PERMUTATION GROUPS Ph.D. Thesis
Harold Lee Putt 1977 91 p
Avail: Univ. Microfilms Order No. 7805371

A mathematical analysis is given based on a theorem which says: Every lattice ordered group can be faithfully represented as a subgroup of the group of all order preserving permutations of some totally ordered set. The work is primarily concerned with partially ordered permutation groups. That is, a permutation group (G, omega) together with a partial ordering of omega which is G-invariant. Motivated by known results on partially ordered groups, we begin the development of a theory for partially ordered permutation groups. Most of the topics discussed are generalizations of topics that are a part of the theory of partially ordered groups. Some of the results are applied to the theory of right partially ordered groups. Dissert Abstr.

N78-23811 Northern Colorado Univ., Greeley.
LINEAR AND NON-LINEAR TECHNIQUES FOR ACCELERATING CONVERGENCE IN SEQUENCES AND SERIES Ph.D. Thesis
Virgil Ray Delegard 1977 94 p
Avail. Univ. Microfilms Order No. 7805492

Numerical methods were explored for accelerating the convergence of slowly convergent sequences and series. Some of these methods can be used with hand held calculators, others need the computational power of a larger computer. All the methods use only the first few terms of the original series, a general expression for the nth term is not necessary. One technique is to fit a polynomial to a set of partial sums and then extrapolate the sum. The other methods involve transforming the original series into a new series that under certain conditions has superior summing properties. Generally, the transformations can be divided into linear and non-linear types depending on how the terms of the original series are combined to form the terms of the transformed series. Dissert. Abstr.

N78-23812 California Univ., Irvine.
FOUNDATIONS OF A GENERAL RELATIVISTIC STATISTICAL MECHANICS FOR INTERACTING PARTICLES AND A DERIVATION OF THE GENERAL RELATIVISTIC BOLTZMANN EQUATION Ph.D. Thesis
Michael Anthony Kovacich 1977 103 p
Avail: Univ. Microfilms Order No. 7805045

A very general mathematical framework for a general relativistic statistical mechanics, including the notions of phase spaces, distribution functions, kinematical dynamics, and average values, was constructed in which all relevant structures are delineated and necessary assumptions are motivated. A generally covariant BBGKY hierarchy was constructed and a derivation is given of the general relativistic Boltzmann equation.
Dissert. Abstr.

N78-23813 Southwestern Louisiana Univ., Lafayette.
A HYBRID TECHNIQUE FOR THE NUMERICAL SOLUTION OF STIFF SYSTEMS OF DIFFERENTIAL EQUATIONS Ph.D. Thesis
Bill Larry Neal 1977 64 p
Avail: Univ. Microfilms Order No. 78-06171

A technique is used to define the hybrid Euler method, which is then compared to other popular methods for finding the solutions of stiff differential systems. It is shown that the hybrid Euler method is about three times faster than other popular methods when used on moderately stiff systems. The hybrid Euler method is shown to be A-stable, but an example is provided which shows that the requirement of A-stability is too weak to guarantee satisfactory results with the hybrid Euler method. The concept of A-stability is therefore generalized and a new concept of system A-stability is introduced. Conditions for system A-stability of the hybrid Euler method are explored, and results are given for two by two linear systems only. Dissert. Abstr.

N78-23814 Cornell Univ., Ithaca, N. Y.
A PENALTY CORRECTION METHOD FOR ELLIPTIC PROBLEMS AND EXTRAPOLATION WITH PARABOLIC PROBLEMS Ph.D. Thesis
Joseph Edward Pasciak 1977 81 p
Avail: Univ. Microfilms Order No. 7806342

A finite element method is introduced for approximating elliptic boundary value problems with inhomogeneous Dirichlet boundary conditions. Approximations which are optimal in H(1), L(2), and the negative Sobolev spaces are provided without very stringent assumptions on the approximating subspaces, viz., the subspaces need not satisfy the Dirichlet boundary conditions or inverse properties. Computationally, the same matrix system is solved, corresponding to Babuska's penalty method, for a number of input vectors to take full advantage of matrix decomposition algorithms. High order approximatins to the normal derivative of the solution are achieved at the boundary without computing normal derivatives. Extrapolation procedures for parabolic problems are also investigated. These include (1) using the penalty correction method at each timestep, and (2) taking, at a fixed time, a linear combination of low order penalty approximations to the parabolic problem. Optimal convergence estimates in L(2) are proven for both methods. Dissert. Abstr.

N78-23815 Wayne State Univ., Detroit, Mich.
APPROXIMATION OF RANDOM FUNCTIONS Ph.D. Thesis
Gary Frank Andrus 1977 67 p
Avail: Univ. Microfilms Order No. 78-05155

The possibility of approximation of random functions by random polynomials or random rational functions is discussed. Two modes of approximation are considered, the first being uniform almost everywhere and the second uniform in probability. In both cases conditions are established under which a given random function can be approximated by a random polynomial or random rational function. Dissert. Abstr.

N78-23816 California Univ., Los Angeles.
SOME MINIMAL ASSUMPTION METHODS IN CLASSIFICATION PROBLEMS Ph.D. Thesis
Gregory Timm Schwemer 1978 417 p
Avail: Univ. Microfilms Order No. 78-06521

The use of fixed and variable kernel algorithms with multivariate Gaussian functions, k-nearest neighbor algorithms, and k-nearest neighbor regression algorithms in two population classification problems require the computation of interpoint distances with a quadratic form distance metric. When the population covariance matrices are used in this metric, the performance of the density estimation procedures is severely degraded. The use of diagonal matrices having the same diagonal elements as the sample covariance matrices was examined. The use of these diagonal matrices in the quadratic form metric is equivalent to the computation of Euclidian distances between points which have undergone a component-wise standardization. The resulting classification procedure is not invariant to linear transformation of the data and this fact suggests an alternative distance metric. Under certain situations this procedure is seen to outperform the linear discriminant function, even when those assumptions are correct. Dissert. Abstr.

N78-23817 Carnegie-Mellon Univ., Pittsburgh, Pa.
A SURVEY OF THE THEORY OF FUNCTIONAL EQUATIONS OF VOLTERRA TYPE Ph.D. Thesis
Elias Yacoub Deeba 1977 146 p
Avail: Univ. Microfilms Order No. 77-27721

An attempt is made to investigate the main ideas and basic techniques used in the study of stability and asymptotic stability and to bring together some of the more recent results which are scattered in various mathematical journals. The presentation is divided into five chapters. The chapters: (1) the basic equations and their applications; (2) stability of solutions on on-linear Volterra equations; (3) existence and stability of functional equations; (4) limit equations; and (5) extensions to the finite dimensional space. Dissert. Abstr.

N78-23818 California Univ., Irvine.
ERROR BOUNDS FOR LABELINGS USED IN COMPUTING FIXED POINTS Ph.D. Thesis
Christopher Lee Bowman 1977 77 p
Avail: Univ. Microfilms Order No. 78-05042

Complementary pivoting fixed point algorithms were developed for arbitrary continuous maps of any compact convex set into itself. The algorithms perform complementary pivoting on a class of labeled simplices in an effort to find a completely labeled simplex. In order to demonstrate the role of labelings in complementary pivoting algorithms, this description determines allowable classes of integer and vector labelings and develops Euclidean norm error bounds for selected labeling. The class of allowable integer labelings is determined by representing integer labelings as conal partitions. Within this class, a new regular integer labeling is defined and its Euclidean norm error is derived. In the area of vector labelings, a class of proper vector labelings is introduced for which completely labeled simplices are guaranteed by using Brouwer's fixed-point theorem. After the Euclidean norm error bound for the standard vectory labeling is derived, the error bounds and vectory labelings are used to compare the efficiency of the resulsing algorithms. Using finite dimensional approximations, error bounds are exhibited for the algorithms when applied to a Banach space with a basis.
Dissert. Abstr.

N78-23819 Arizona Univ., Tucson.
APPLICATIONS OF CLEBSCH POTENTIALS TO VARIATIONAL PRINCIPLES IN THE THEORY OF PHYSICAL FIELDS Ph.D. Thesis
Richard Baumeister 1977 173 p
Avail: Univ. Microfilms Order No. 78-05775

A generalized Hamilton-Jacobi theory was derived for parameter dependent and for parameter invariant variational principles. It was shown that these generalized theories are valid, irrespective of any assumptions concerning the dependence or otherwise of the components p sub 1 p sub n. Finally, it was shown that the parameter invariant Hamilton-Jacobi theory may be used to establish new variational principles for general relativistic perfect fluids. Dissert. Abstr.

N78-23820# Minnesota Univ., Minneapolis. School of Mathematics.
GENERALIZED INVERSES OF LINEAR DIFFERENTIAL OPERATORS Technical Summary Report
W. S. Loud Mar. 1978 54 p refs
(Grant DA-ARO(D)-31-124-73-G199)
(AD-A052170; ARO-11600.4-M) Avail: NTIS HC A04/MF A01 CSCL 12/1

In recent years there has been much activity in the area of generalized inverses of linear operators. It is the purpose of this paper to discuss generalized inverses of linear operators generated by ordinary linear differential equations with a view to examination

of an entire class of such inverses. The class of inverses considered includes as special cases the analogue of the Moore-Penrose generalized inverse for matrices and the group inverse for square matrices. We also discuss the application of such inverses in problems of branching of solutions of nonlinear boundary-value problems. Author (GRA)

N78-23821# Oklahoma State Univ., Stillwater. School of Electrical Engineering.

FIXED CONFIGURATION REDUCED ORDER FILTERS Final Report, 1 Mar. - 31 Dec. 1977

Craig S. Sims Feb. 1978 104 p refs
(Grant AF-AFOSR-3248-77; AF Proj. 2305)
(AD-A051185; OSU-CS-78-1; AFOSR-78-0351TR) Avail: NTIS HC A06/MF A01 CSCL 12/1

Fixed configuration filter theory provides a methodology for designing filters of reduced complexity which will provide suboptimal performance in general, and optimal performance under certain conditions. In this report we derived fixed configuration reduced order filters for continuous and discrete time systems, with and without state dependent noise. Author (GRA)

N78-23822# Texas Univ., Austin. Center for Numerical Analysis.

COMPUTATIONAL AND APPLIED MATHEMATICS Final Report, 1 Oct. 1974 - 30 Nov. 1977

David M. Young, Jr. 31 Jan. 1978 5 p refs
(Grant DAHC04-74-G-0198)
(AD-A051493; ARO-12301.5-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

This is the final report of the work performed under the grant at the Center for Numerical Analysis, The University of Texas at Austin. The report summarizes the research performed, lists the papers published and in progress, and lists the personnel who participated in the work. GRA

N78-23823# Massachusetts Inst. of Tech., Cambridge. Operations Research Center.

THE STRUCTURE OF ADMISSIBLE POINTS WITH RESPECT TO CONE DOMINANCE

G. R. Bitran and Magnanti Jun. 1977 62 p refs Prepared in cooperation with Univ. Catholique de Louvain, Belgium
(Contracts DAAG29-76-C-0064; N00014-67-A-0244-0076)
(AD-A051540; ARO-14261.6-M) Avail: NTIS HC A04/MF A01 CSCL 12/1

The set of admissible (pareto-optimal) points of a closed convex set X is studied when preferences are described by a convex, but not necessarily closed, cone. Assuming that the preference cone is strictly supported and making mild assumptions about the recession directions of X, a representation theorem of Arrow, Barankin and Blackwell is extending by showing that all admissible points are either limit points of certain strictly admissible alternatives or translations of such limit points by rays in the closure of the preference cone, and show that the set of strictly admissible points is connected, as is the full set of admissible points. Relaxing the convexity assumption imposed upon X, local properties of admissible points are considered in terms of Kuhn-Tucker type characterizations. Necessary and sufficient conditions are specified for an element of X to be a Kuhn-Tucker point, conditions which, in addition, provide local characterizations of strictly admissible points. GRA

N78-23824# RE/SPEC, Inc., Rapid City, S. Dak.

GENERAL DESCRIPTION OF THE FINITE-ELEMENT METHOD OF ANALYSIS IN ENGINEERING MECHANICS

H. Hovland and J. E. Russell 5 Oct. 1977 16 p refs Prepared in cooperation with Union Carbide Corp., Oak. Ridge, Tenn.
(Contract W-7405-eng-26)
(ORNL/SUB-3706-3) Avail: NTIS HC A02/MF A01

The finite element method is a numerical technique of analysis in engineering mechanics, and was developed simultaneously with the increasing use of high speed electronic digital computers. For many engineering problems in real life, it is not possible to obtain an analytical solution. An analytical solution is a mathematical expression that gives the values of an unknown desired quantity at any location in a body in relation to the material behavior and prescribed boundary and/or initial conditions. In general, analytical solutions can only be obtained for simplified problems, notably of the linear class. When a problem involves temperature and/or stress dependent material properties, nonlinear deformations and complex boundary conditions, one is forced to make use of a computerized solution scheme in order to obtain the proper values of the unknowns at given discrete points in the continuum or body. ERA

N78-23825# Maryland Univ., College Park. Computer Science Center.

A-POSTERIORI ERROR ESTIMATES FOR THE FINITE ELEMENT METHOD

I. Babuska and W. C. Rheinboldt Sep. 1977 38 p refs
(Contract EY-76-S-05-3443; E(40-1)-3343; Grant NSF MCS-72-03721)
(ORO-3443-68; TR-581; MCS72-03721A06-581) Avail: NTIS HC A03/MF A01

Computable a posteriori error estimates for finite-element solutions are derived in an asymptotic form for h approaching limits of 0 where h measures the size of the elements. The approach has similarity to the residual method, but differs from it in the use of norms or negative Sobolev spaces corresponding to the given bilinear (energy) form. For clarity the presentation is restricted to one-dimensional model problems. More specifically, the source, eigenvalue, and parabolic problems are considered involving a linear, self-adjoint operator of the second order. Generalizations to more general one-dimensional problems are straightforward, and the results also extend to higher space dimensions; but these involve some additonal considerations. The estimates can be used for a practical a posteriori assessment of the accuracy of a computed finite-element solution, and they provide a basis for the design of adaptive finite-element solvers. ERA

N78-23826# Illinois Inst. of Tech., Chicago. Dept. of Computer Science.

METHODS FOR OSCILLATING PROBLEMS

L. Petzold and G. W. Gear Oct. 1977 36 p refs
(Contract EY-76-S-02-2383)
(COO-2383-45; UILU-ENG-77-1752) Avail: NTIS HC A03/MF A01

Initial-value problems for ordinary differential equations with highly oscillatory solutions are considered. A solution method, applicable to linear or nonlinear oscillations, is discussed; essentially, the method defines an envelope and attempts to compute that. This method stops over many periods at a time. A method for correcting an initial estimate of the period is disclosed. Some theoretical results are proved, and a numerical example is presented. Author (ERA)

N78-23827# California Univ., Berkeley.

DYNAMIC ADI METHODS FOR ELLIPTIC EQUATIONS WITH GRADIENT DEPENDENT COEFFICIENTS Ph.D. Thesis

Said Doss Apr. 1977 131 p refs
(Contract W-7405-eng-48; Grants NSF MPS-73-08593; NSF MCS-76-06967)
(LBL-6142) Avail: NTIS HC A07/MF A01

The dynamic alternating direction implicit (DADI) methods, previously introduced and applied to elliptic problems with linear and nonlinear coefficients (a(u)), are applied here to elliptic problems with nonlinear gradient-dependent coefficients (a(grad u)), such as the minimal surface equation, the capillary surface equation, and the magnetostatic equation. Certain improvements for these methods are developed, and they are extended to 3 directional or 3 dimensional situations. ERA

N78-23828# California Univ., Livermore. Lawrence Livermore Lab.

FITTING NOISY DATA WITH A COMPLEX EXPONENTIAL SERIES

D. G. Dudley (Ariz. Univ., Tucson) 7 Mar. 1977 28 p refs
(Contract W-7405-eng-48)
(UCRL-52242) Avail: NTIS HC A03/MF A01

The process of fitting noisy data with a complex exponential series is considered. An analysis of the classical Prony method showed that attempts to obtain accurate answers in the presence of noise met with considerable difficulties. Recasting the problem as one of system identification and applying the least squares

method leads to biased estimates of the parameters in the characteristic equation for the system. The difficulty centers around the fact that neither classical Prony nor least squares involves any analysis, identification, smoothing, or filtering of the noise. Some techniques for improving results are discussed, and an iterative generalized least-squares procedure, which leads to a noise filter, is recommended. ERA

N78-23829# Technische Universitaet, Munich (West Germany). Inst. fuer Astronomische und Physikalische Geodaesie.
NUMERICAL QUADRATURE OF INTEGRALS WITH RAPIDLY OSCILLATING INTEGRANDS IN VIEW OF SOLVING SELFADJOINT BOUNDARY VALUE PROBLEMS [ZUR NUMERISCHEN QUADRATUR VON INTEGRALEN MIT SCHNELL OSZILLIERENDEN INTEGRANDEN IM RAHMEN DER LOESUNG SELBSTADJUNGIERTER RANDWERTAUFGABEN]
Karl Heinz Ilk 21 Mar. 1977 73 p refs In GERMAN; ENGLISH summary Sponsored by Deut. Forschungsgemeinschaft
(TUM-Mitt-138) Avail: NTIS HC A04/MF A01

Generating reference orbits for satellite geodesy by solving two point selfadjoint boundary value problems requires the evaluation of different types of integrals by means of numerical quadrature. A number of algorithms are being presented for evaluating integrals with rapidly oscillating integrands and integrals with variable upper limits. For both types of integrals the same set of mesh points can be used. Author (ESA)

N78-23830# Royal Netherlands Meteorological Inst., De Bilt.
ITERATIVE METHODS TO SOLVE SETS OF COUPLED ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS [ITERATIEVE METHODEN VOOR HET OPLOSSEN VAN STELSELS GEKOPPELDE ELLIPTISCHE PARTIELE DIFFERENTIAALVERGELIJKINGEN]
S. J. Bijlsma 1977 20 p refs In DUTCH; ENGLISH summary
(KNMI-WR-77-7) Avail: NTIS HC A02/MF A01

Systems of coupled Helmholtz equations were solved using point and line iterative (SOR) methods with different orderings. A comparison of these methods was made by giving the number of iterations needed to reduce a given initial error by different reduction factors. ESA

N78-23831# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
ON THE EXISTENCE OF RADIAL BOUNDARY VALUES FOR FUNCTIONS SUBHARMONIC IN A LIPSCHITZ DOMAIN
Bjoern E. J. Dahlberg 1977 22 p refs
(CTH-Math-1977-3) Avail: NTIS HC A02/MF A01

An analogue of the Littlewood theorem was studied in the case of functions that are subharmonic in a Lipschitz domain. Results are given for the radial boundary values of subharmonic functions, and it is shown that limits, the value of which are estimated, do exist almost everywhere. A potential is constructed and consequences of the results are discussed. Author (ESA)

N78-23832# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
ON ARRANGEMENTS WHICH DETERMINE LIMIT THEOREMS FOR EIGENVALUES OF A SAMPLE COVARIANCE MATRIX
Harald Bergstroem 1977 15 p refs
(CTH-Math-1977-9) Avail: NTIS HC A02/MF A01

A new demonstration is given showing that the empirical distribution of the eigenvalues of sample covariance matrices converge in probability to a certain distribution function under conditions which are determined. It is shown that an essential number appearing in a previous demonstration by Jonsson is the number of arrangements of elements in a sequence of K elements where some or all belong to s different classes. The arrangements should have certain very elementary general properties. The general significance of the number of arrangements thus defined is discussed. Author (ESA)

N78-23833# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Computer Sciences.
ON A CLASS OF DIFFERENCE APPROXIMATIONS TO THE WAVE EQUATION
Karl Erik Karlsson 1976 117 p refs
(CTH-76.03-R) Avail: NTIS HC A06/MF A01

A class of difference approximations was found in order to solve the Cauchy problem for the wave equations. The difference approximations used are generally dissipative. The rate of convergence in the space L sub p of the approximations were estimated in terms of the smoothness of the initial data and the orders of approximation and dissipation of the difference scheme. Precise information is given on the way a discontinuity propagates in the difference approximation when the initial data are step functions. Examples are given and the behavior of some difference schemes, generalized to several space variables, is illustrated in numerical computations. ESA

N78-23834# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Computer Sciences.
CHEBYSHEV-POLYNOMIALS FOR SETS CONSISTING OF TWO DISJOINT INTERVALS WITH APPLICATIONS TO CONVERGENCE ESTIMATES FOR THE CONJUGATE GRADIENT METHOD
Barbro Atlestam 1977 25 p refs
(CTH-77.06-R) Avail: NTIS HC A02/MF A01

A method was obtained to estimate the number of iterations required when, using the conjugate gradient method for solving systems of linear equations of order n, the initial error must be reduced by a given factor epsilon. The cases where, in the system AX = f, the matrix A is positive definite and symmetric, are considered first and the results are extended to the case where the positive definite requirement is relaxed. The problem dealt with is treated under the fundamental hypothesis that the Chebyshev polynomials involved related to the spectrum of the matrix A be those found when the spectrum of A belongs to the union of two closed, bounded, disjoint sets on the strictly positive part of the real line. ESA

N78-23835# International Institute for Applied Systems Analysis, Laxenburg (Austria).
THE AVERAGING METHOD APPLIED TO THE INVESTIGATION OF SUBSTANTIAL TIME VARYING SYSTEMS OF A HIGHER ORDER
N. Vorontsov Sep. 1977 20 p refs
(IIASA-PP-77-8) Avail: NTIS HC A02/MF A01

An analytical method for solving a system of differential equations describing a substantial time-varying feedback control system is presented. The method provides good results for systems whose characteristic equations have dominant complex conjugated roots. As an example, a five-order system was investigated. The results of the computer simulation proved the validity of applying this method to the above mentioned class of systems. Author (ESA)

N78-23836# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
THE REPRESENTATION OF POLYNOMIALS IN TERMS OF B-SPLINES
M. G. Cox Dec. 1977 36 p refs Presented at the 7th Manitoba Conf. on Numerical Math. and Computing, Winnipeg, Can., Sep./Oct. 1977
(NPL-NAC-85) Avail: NTIS HC A03/MF A01

The problem of converting powers of x and polynomials into linear combinations of B-splines was considered. New 3 term recurrence relations for these tasks were derived; simple algorithms based upon them are presented. Floating point error analyses of the algorithms are given, a priori bounds being obtained in some important cases. In all cases a posteriori bounds can readily be determined by a running error analysis. The algorithms are extremely efficient in terms of the number of arithmetic operations required compared with approaches based upon interpolation and upon the direct use of the fundamental identity due to Marsden. Author (ESA)

N78-23837# European Space Agency, Paris (France).
SPECTRAL APPROXIMATION OF A CLASS OF OPERATORS AND APPLICATIONS
Rabah Tahraoui Mar. 1978 84 p refs Transl. into ENGLISH of 'Approximation Spectrale d'une Classe d'Operateurs et Appl.', ONERA, Paris Report ONERA-NT-1976-1, Sep. 1977 Original report in FRENCH previously announced as N78-15455

(ESA-TT-445; ONERA-NT-1976-1) Avail: NTIS HC A05/MF A01

The approximation of a class of operators comprising elliptic differential operators is dealt with. The approximation of the eigenvalues and eigenvectors of these operators is covered. The results obtained are applied to the case of approximation by the finite element method of eigenvalue problems for some classical operators. A numerical application to the calculation of the vibrations of a partially filled tank illustrates these results.

Author (ESA)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N78-23838 Wisconsin Univ., Madison.
THE QUADRATURE METHOD IN INFERENCE PROBLEMS ARISING FROM THE GENERALIZED MULTINOMIAL DISTRIBUTION Ph.D. Thesis
Lien-Ju Anne Chao 1977 166 p
Avail: Univ. Microfilms Order No. 7728240

The following estimation problems based on the sample occupancy numbers are discussed: (1) Estimation of the coverage of the sample; (2) Prediction of the coverage and the number of classes of an augmented sample; (3) Estimation of H(m,n) = sum of p sub i to the m power (-log p sub i) to the n power, especially for H(2,0) = sum p sub i squared and H(1,1) = sum of p sub i (-log p sub i); (4) Estimation of the number of classes in the population. Two moment estimators are investigated and some of their properties were determined. Based on the first few moment estimators, this work characterizes the quadrature estimators and a detailed picture is developed to analyze the behavior of quadrature estimators. Generated data sites are utilized to illustrate the method and make comparisons. Dissert. Abstr.

N78-23839 Georgia Univ., Athens.
MODEL SELECTION FOR LIFE SPAN DISTRIBUTION Ph.D. Thesis
Wai-sun William Chen 1977 103 p
Avail: Univ. Microfilms Order No. 78-05990

The separate family test and the usual significance testing situation are examined in order to develop a statistical test for choosing from among two similar probability distributions. Tests for the following choices are developed: (1) H sub f log-normal; H sub g: exponential; (2) H sub f log-normal; H sub g: gamma; (3) H sub f log-normal; H sub g: Weibull; (4) H sub f exponential; H sub g: gamma; (5) H sub f exponential; H sub g: Weibull; (6) H sub f gamma; H sub g: Weibull. In all cases the alternative hypotheses H sub g is merely one possible alternative to the null hypothesis H sub f and the observation will not necessarily fit either distribution. Dissert. Abstr.

N78-23840 Florida State Univ., Tallahassee.
G-ORDERED FUNCTIONS, WITH APPLICATIONS IN STATISTICS Ph.D. Thesis
John Charles Conlon 1977 78 p
Avail: Univ. Microfilms Order No. 7804970

Using the theory of reflection groups, a partial ordering on Euclidean n-space, called reflection ordering, and the corresponding isotonic functions, called G-ordered functions are defined. For any point r on the unit ball in Euclidean n-space, the matrix, M sub r = I - 2rr', is the reflection defined by r. The group G generated by reflections under matrix multiplication is a reflection group. The properties of G-ordered functions are used to obtain results for a related class of functions, called G-monotone functions. The composition theorem for G-ordered functions is used to show that the convolution of G-monotone decreasing functions is G-monotone decreasing. Many commonly used multivariate densities are shown to be G-ordered; in fact, any elliptically-contoured density is G-ordered. An application of G-ordered functions to certain well-known tests of a multivariate hypothesis is presented. Sufficient conditions on the distribution of the observations are determined so that the tests have G-monotone increasing power functions. Dissert. Abstr.

N78-23841 Oklahoma State Univ., Stillwater.
LINEAR STATISTICAL INFERENCE AS RELATED TO INVERSE GAUSSIAN DISTRIBUTION Ph.D. Thesis
Anne Sobiegraj Davis 1977 67 p
Avail: Univ. Microfilms Order No. 7805703

This study is an investigation into statistical inference on the inverse Gaussian distribution. The bulk of the study concentrates on using the inverse Gaussian distribution in regression analysis. Dissert. Abstr.

N78-23842 Cornell Univ., Ithaca, N. Y.
SELECTION PROCEDURES FOR ORDERED FAMILIES OF DISTRIBUTIONS Ph.D. Thesis
Jeffrey Hollis Hooper 1977 213 p
Avail: Univ. Microfilms Order No. 7806333

The infimum of the probability of a correct selection over all configurations of star, convex, and tail ordered families of distributions was determined for both fixed and random size subset selection procedures. The results do not entail the assumption that the distributions of all nonpreferred populations are stochastically smaller than the distributions of all preferred populations, and in fact this assumption appears to have little effect on the infimum of the probability of a correct selection. In all cases it was shown that this infimum approaches one as n approaches infinity. The properties of monotonicity and unbiasedness were also investigated for these procedures.

Dissert. Abstr.

N78-23843 Florida Univ., Gainesville.
CONTRIBUTIONS TO STATISTICAL TECHNIQUES FOR TWO AND THREE DIMENSIONAL MEASUREMENT PROBLEMS Ph.D. Thesis
James Robert Lackritz 1977 119 p
Avail: Univ. Microfilms Order No. 7806715

Estimation of structural properties of two and three-dimensional figures can be achieved through areal, lineal, and point sampling techniques. Such properties might include areal and volume fractions, surface area per unit volume, and boundary length per unit area. Unbiased estimators for the individual parameters are well known, and have been used for quite some time in the research associated with this field. Additional properties of the individual estimators were developed, including consistency and asymptotic normality, and practical variance approximations are given. These properties were derived under the assumption of a general cell model for the construction of the population figure. Once the general results were obtained, special cases of more specific models were examined.

Dissert. Abstr.

N78-23844 Ohio State Univ., Columbus.
THE GENERALIZED VARIANCE Ph.D. Thesis
Virginia Lee 1977 99 p
Avail: Univ. Microfilms Order No. 78-05873

Based on a random sample from one or two bivariate normal populations and under various assumptions on the mean vector(s), the likelihood ratio test is carried out for the hypothesis of the equality of the generalized variance to a constant and for the hypothesis of the equality of two generalized variances. However, prior to carrying out the likelihood ratio test procedure, the maximum likelihood estimate of the covariance matrix, is found under the null hypothesis and under the various assumptions on the mean vector(s). Assuming the equality of two generalized variances, the maximum likelihood estimate of the common generalized variance is, also, found. It is shown that the likelihood ratio test for the respective hypotheses may be based on the F-distribution. Dissert. Abstr.

N78-23845 Wisconsin Univ., Madison.
STUDIES IN THE ANALYSIS OF SERIALLY DEPENDENT DATA Ph.D. Thesis
Lars Chr. Pallesen 1977 191 p
Avail: Univ. Microfilms Order No. 78-02972

Assuming that the noise in a linear model (with p-dimensional parameter vector theta) follows a first order autoregressive scheme (with parameter phi) it is developed how in the Bayesian framework inferences can be drawn about theta and phi jointly, conditionally, and marginally. Two AR-1 schemes are considered, one covering explosive as well as stationary situations, the other assumes

stationarity and reversibility a priori. The important task of choosing an appropriate joint prior distribution for the parameters is given special attention. Dissert. Abstr.

N78-23846 American Univ., Washington, D. C.
OPTIMAL DECISION POLICIES IN A PURPOSIVE SYSTEM: THE SEMI-MARKOV DECISION PROCESS AS A MODEL Ph.D. Thesis
David Lowell Thomas 1977 78 p
Avail: Univ. Microfilms Order No. 78-04618

A modified iteration procedure was used to produce good decision sequences for certain multi-stage decision systems having stationary probabilities and time-varying utilities. The semi-Markov decision process provides an adequate model for describing system behavior in the framework of the purposive system. It provides a specific mathematical model of system behavior, which is additionally used to produce decision policies in the purposive system. Dissert. Abstr.

N78-23847 Wisconsin Univ., Madison.
SOME DISTRIBUTIONAL PROPERTIES AND COMPARISONS OF SHRINKAGE ESTIMATORS Ph.D. Thesis
Richard Craig VanNostrand 1977 142 p
Avail: Univ. Microfilms Order No. 7828280

The posterior distribution of ALPHA = N to the 1/2 power BETA/Sigma was derived using locally uniform priors and provides a normal approximation to this distribution. These results were used, in turn, to derive the posterior distribution of the shrinkage matrix. A shrinkage estimator differs less and less from the corresponding least squares estimator as the least squares estimator is more and more statistically significant. This is true for all the shrinkage estimators examined. However, for p independent predictor variables, the Bayes risk criterion indicates that one should use shrinkage estimators only for more significant regression coefficients. Dissert. Abstr.

N78-23848 Georgia Univ., Athens.
SELECTION OF REGRESSION VARIABLES USING COST CRITERIA Ph.D. Thesis
Thomas Phillip Ryan 1977 97 p
Avail: Univ. Microfilms Order No. 7806034

Ways in which the acquisition costs of regression variables might be utilized in selecting a subset of these variables from a larger set of variables were investigated. A method to approximate the minimum of a function of acquisition costs and the residual sum of squares was developed. A simulation was performed to test the efficiency of the approximation method, and the method was found to be quite efficient for 4-variable problems. A new simulation procedure was also developed for performing the simulation. One of the existing selection procedures was subsequently modified to include cost criteria and subset selection comparisons were made for the various procedures. The procedure that was judged to be the best was subsequently applied to a real world problem and difficulties in applying the procedure to large problems were noted. Dissert. Abstr.

N78-23849 Illinois Univ. at Chicago Circle, Chicago.
INFINITELY DIVISIBLE PROBABILITY LAWS Ph.D. Thesis
Damber Singh Tomer 1977 130 p
Avail: Univ. Microfilms Order No. 78-05487

Addressed is the problem of investigating the relationships among various definitions of infinite divisibility as contained in the literature. The concepts of strong and weak infinite divisibility for an arbitrary random variable are defined and further discussed for their inter-relationships. Some well known results about infinitely divisible distributions are stated and used in investigating the relationship among self-decomposable, stable and infinitely divisible laws. The concept of family-wise infinite divisibility and infinite convolution are also defined, and the distributions are investigated for family-wise infinite divisibility with respect to the natural family. Results about the relationship of moments (cumulants) of an infinitely divisible distribution are obtained and their limiting form is also discussed. The concept of infinite divisibility is extended to random vectors. Dissert. Abstr.

N78-23850 Texas Univ. Health Science Center, Houston.
MEASURES OF ASSOCIATION FOR CIRCULAR VARIABLES Ph.D. Thesis
Clayton Wentworth Eifler 1977 263 p
Avail: Univ. Microfilms Order No. 78-06545

This work is concerned with the planar case of angles or variables whose values can be considered to lie on the circumference of a circle. At least four measures of association for pairs of such variables are developed and discussed. Sampling distribution theory is derived for each. Two of the measures give bases for nonparametric tests of independence. A third statistic is based on the correlation of sines and cosines of certain angles. Lastly, a group of transformations which can be considered analogues to the scale transformations on the real line is presented, and it is shown how this group can be used to develop a theory for correlation of circular variables which is analogous to the theory of correlation for linear variables. Several bivariate densities on the torus are also given. Dissert. Abstr.

N78-23851# Indiana Univ., Bloomington. Dept. of Mathematics.
ASYMPTOTIC MULTINORMALITY AND REMAINDER TERMS OF LINEAR RANK VECTORS UNDER ALTERNATIVES Interim Report
Madan L. Puri and Navaratna S. Rajaram 28 Feb. 1978 27 p refs
(Grant AF-AFOSR-2927-76; AF Proj. 2304)
(AD-A051863; AFOSR-78-0434TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

Asymptotic multinormality of linear rank statistics based on independent vector valued random variables is obtained. Under suitable assumptions, weak estimates for the remainder terms for convergence to normality are compared. GRA

N78-23852# Indiana Univ., Bloomington. Dept. of Mathematics.
ANALYSIS OF CENTRAL PLACE THEORY Interim Report
Madan L. Puri, K. V. Mardia, and R. Edwards 4 Mar. 1978 28 p refs Prepared in cooperation with Leeds Univ., England
(Grant AF-AFOSR-2927-76)
(AD-A051861; AFOSR-78-0432TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

Central Place Theory predicts a regular spatial pattern in the plane and it is observed that the Delaunay triangles will be equilateral under the theory. However, when the pattern is random, the asymptotic p.d.f. of the interior angles of a random Delaunay triangle are given. A von Mises-type model is proposed with a concentration parameter K; the larger the value of K, the closer one is to the Central Place Theory. The model can be approximated to the Miles: density for some value of K. The moment and maximum likelihood estimators of K are provided, and it is recognized that the areas of the Delaunay triangles play an important role. A test of departure from the random pattern is constructed with the alternative of Central Place Theory. As a numerical example, 44 Central Places in Iowa are analyzed where some evidence for the validity of Central Place Theory in that particular region is found. GRA

N78-23853# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
G-SPECTRAL ESTIMATION
H. L. Gray Sep. 1977 3 p refs
(Contract N00014-75-C-0439)
(AD-A051849) Avail: NTIS HC A02/MF A01 CSCL 12/1

The G transformation has been shown to be of value in evaluating improper integrals and was especially effective in those cases where the integrand behaved like a linear combination of exponentials with real or complex arguments. These ideas have more recently been utilized to define a spectral estimator referred to as the G spectral estimator. In this paper the nature of the G transform and G spectral estimator are discussed and it is pointed out that such an estimator is most appropriate for processes whose autocorrelations behave as a linear combination of exponentials with real or complex arguments. GRA

N78-23854# Rochester Univ., N. Y. Dept. of Statistics.
A COMPARISON OF TWO TESTS FOR THE SIGNIFICANCE OF A MEAN VECTOR Interim Report
Perla Subbaiah and Govind S. Mudholkar 1978 19 p refs Prepared in cooperation with Oakland Univ., Rochester, Mich.
(Grant AF-AFOSR-3360-77)

(AD-A051848; AFOSR-78-0435TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Hotelling's T-square procedure for testing the significance of a mean vector treats all variables symmetrically and may not be appropriate if the variables carry unequal importance. The step-down procedure, a possibly appropriate alternative, is studied in this paper. An underlying invariance structure is established and then used to develop a canonical form for studying the power functions of the two methods. A Monte Carlo experiment is conducted in this framework and conclusions are reported. GRA

N78-23855# Florida State Univ., Tallahassee.

G-ORDERED FUNCTIONS IN STATISTICS

J. C. Conlon, R. Leon, F. Proschan, and J. Sethuraman Jun. 1977 26 p refs

(Grants DAAG29-76-G-0238; AF-AFOSR-2581-74; ES07011) (AD-A051654; FSU-Statistics-M421; TR-71-AFOSR; ARO-13888.11-MX; AROD-TR-22) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper generalizes and extends work for functions decreasing in transposition (DT). It introduces reflection ordering and G ordered functions and develops many preservation properties for these functions. G ordered functions contain, as a special case, G monotone functions and a preservation theorem for G-monotone functions is shown under an integral transform. The results are extended in the area of stochastic comparisons to a larger class of probability distributions. GRA

N78-23856# Georgia Inst. of Tech., Atlanta. School of Industrial and Systems Engineering.

STUDIES IN SUPPORT OF THE APPLICATION OF STATISTICAL THEORY TO DESIGN AND EVALUATION OF OPERATIONAL TESTS Final Summary Report

Douglas C. Montgomery, Harrison M. Wadworth, Leslie G. Callahan, and Russell G. Heikes Jul. 1977 89 p refs

(Contract DAAG39-76-C-0085)

(AD-A051997) Avail: NTIS HC A05/MF A01 CSCL 12/1

This report is a summary report of four studies in support of the application of statistical theory to design and evaluation of operational tests. The four topics are: A Methodology for Determining the Power of MANOVA when the Observations are Serially Correlated; An Application of Multiple Response Surface Optimization to the Analysis of Training Effects in Operational Test and Evaluation; A Cost Optimal Approach to Selection of Experimental Designs for Operational Testing under Conditions of Constrained Sample Size; and An Application of Bayesian Statistical Methods in the Determination of Sample Size for Operational Testing in the US Army. GRA

N78-23857# Stanford Univ., Calif. Dept. of Operations Research.

VARIANCE REDUCTION TECHNIQUES FOR THE SIMULATION OF MARKOV PROCESSES. 3: INCREASING THE FREQUENCY OF REGENERATIONS

Philip Heidelberger Jan. 1978 23 p refs

(Contract N00014-76-C-0578; Grant NSF MCS-75-23607) (AD-A051431; SU-TR-45-3) Avail: NTIS HC A02/MF A01 CSCL 12/1

One of the main difficulties with the regenerative method of simulation is that even though a process may be known to be regenerative, regenerations may occur quite infrequently. A class of methods, based on Dynkin's formula, is considered that increases the frequency of regenerations when the process being simulated is a Markov chain. Instead of simulating the original Markov chain, a new Markov chain is simulated from which point estimates and confidence intervals for parameters of the original chain's stationary distribution may be formed. Because regenerations occur more frequently in the new chain, such confidence intervals will usually be shorter than is otherwise possible. Author (GRA)

N78-23858# Stanford Univ., Calif. Dept. of Operations Research.

VARIANCE REDUCTION TECHNIQUES FOR THE SIMULATION OF MARKOV PROCESSES. 2: MATRIX ITERATIVE METHODS

Philip Heidelberger Jan. 1978 40 p refs

(Contract N00014-76-C-0578; Grant NSF MCS-75-23607) (AD-A051430; SU-TR-44-2) Avail: NTIS HC A03/MF A01 CSCL 12/1

The techniques of numerical analysis and simulation are combined by partially solving an appropriate system of linear equations using some matrix iterative procedure and then estimating the difference between the true and partial solutions via simulation. Numerical results for a simple queueing model are presented. Author

N78-23859# Georgia Inst. of Tech., Atlanta.

A COMPARISON OF CLASSICAL AND BAYESIAN STATISTICAL ANALYSIS IN OPERATIONAL TESTING M.S. Thesis

Philip Vincent Coyle Jun. 1977 80 p refs

(AD-A051260) Avail: NTIS HC A05/MF A01 CSCL 12/1

This research is devoted to investigating how Bayesian statistical analysis differs from classical statistical analysis in the context of operational testing. The specific aspects of operational testing which are considered are the power resulting from a hypothesis test and the expected loss, or risk, resulting from a decision. First it is shown that it is quite difficult to develop a meaningful measure of comparison between Bayesian and classical analysis in the framework of hypothesis testing. Using the power of the hypothesis test as a measure of comparison, it is shown that under certain conditions classical statistical procedures lead to more powerful tests than Bayesian procedures. It is then shown that Bayesian statistical procedures are superior to classical procedures in the framework of minimizing expected loss or risk. Author (GRA)

N78-23860# Oak Ridge National Lab., Tenn.

INDUCTIVE MODELLING OF POPULATION TIME SERIES

B. W. Rust and B. L. Kirk 1977 52 p refs Presented at SIMS Conf. on Statist. Analysis of Ecol. Processes in Time and Space, Alta, Utah, 27 Jun. 1977

(Contract W-7405-eng-26)

(CONF-770689) Avail: NTIS HC A04/MF A01

A method for modeling time series is considered which is based on the iterative combination of statistical regression and spectral analysis techniques. The goal is to find a model which reduces the residuals to a white noise series. The use of the technique is illustrated by considering two examples: striped bass catch curves for the Atlantic coast fisheries, and the time series for the buildup of CO2 in the atmosphere. Finally, the application of the technique to the 10-year wildlife cycle is briefly discussed. ERA

N78-23861# Technische Universitaet, Brunswick (West Germany). Inst. fuer Geophysik und Meteorologie.

THE GAUSSIAN TABLES OF THE FREQUENCY OF PRIME NUMBERS IN CENTADES [ZU DEN GAUSS'SCHEN TABELLEN DER HAEUFIGKEIT VON PRIMZAHLEN IN CENTADEN]

H. W. Bartels 7 Jun. 1977 31 p refs In GERMAN

(GAMMA-28) Avail: NTIS HC A03/MF A01

The Gaussian counts on the number of prime numbers per centade was repeated and extended. Results are presented in tables. The behavior of the mean deviation of the number of primes per centade is made plausible by a model based on a Bernouilli distribution. A similar model for decades corresponds well with counts. ESA

N78-23862# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.

ON THE DISTRIBUTION OF FEKETE POINTS

Bjoern E. J. Dahlberg 1977 8 p refs

(CTH-Math-1977-6) Avail: NTIS HC A02/MF A01

Estimates of the distance from a Fekete point to its nearest neighbor are given that improve on previous results obtained in cases where the compact set E to which the Fekete points belong is contained within R square or where E is a C sup 1, alpha closed surface for R cube or higher. ESA

N78-23863# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.

ON THE ASYMPTOTIC BEHAVIOR OF LINE PROCESSES AND SYSTEMS OF NON-INTERACTING PARTICLES

Olav Kallenberg 1977 47 p refs
(CTH-Math-1977-13) Avail: NTIS HC A03/MF A01

The asymptotic behavior in time of a system of non-interacting particles is clearly equivalent to the asymptotic behavior under translations of the corresponding line process in the space-time diagram. In case of space stationarity, the limit, if it exists, must correspond to a line process which is stationary under arbitrary translations. Such processes are known to be Cox under various regularity conditions, as shown by Papangelou and the author. In the present paper, the arguments from stochastic geometry used to prove such results are extended to establish convergence towards Cox processes under various types of general assumptions, such as local invariance of mixing conditions. One of the main results is a common extension of a classical convergence theorem by Breiman and Stone in the case of independent velocities and of the known results providing sufficient conditions for a line process in R to the power d (with d higher or equal to 3), to be Cox. Author (ESA)

N78-23864# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
SOME PRACTICAL APPLICATIONS IN DISCRETE MULTIVARIATE APPROXIMATION
J. G. Hayes Oct. 1977 30 p refs Presented at the Res. Symp. on Multivariate Approx., Durham, Engl., Jul. 1977
(NPL-NAC-84) Avail: NTIS HC A03/MF A01

Some practical applications of multivariate approximation, in two up to ten or so independent variables, are described, and the considerations which arise in such problems over and above the question of providing sound numerical algorithm are discussed. Chief among these considerations is the need to construct a suitable functional form with which to carry out the approximation. The following applications are discussed: transistor voltage (2 independent variables), ship fairings (2 variables), lifting gear (2 and 3 variables), distant-water trawlers (6 variables), smaller fishing vessels (10/12 variables). Author (ESA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N78-23865 California Univ., Los Angeles.
AN OPTIMUM PROCESSING TECHNIQUE FOR MOVING TARGET INDICATION IN SPACE SURVEILLANCE Ph.D. Thesis
Ronald Edward Fountain 1977 203 p
Avail: Univ. Microfilms Order No. 7802595

An optimum processing technique was determined to enhance target detection by virtue of eliminating the stationary background. A step-stare optical system on board a synchronous orbited satellite could be used to acquire several discrete frames of data. The complete set of data frames acquired could then be precorrelated to form the best estimate of the spatial background, therefore allowing for the optimum rejection of stationary objects. After which, a modified set of data frames created by the precorrelation process could be formed that would be relatively cleansed of the stationary star background. A matrix of observation data was formulated to show the advantages of utilizing the entire data set rather than the commonly employed frame differencing approach to determine estimates of the stellar background. An optimum digital processing technique for target detection could then be determined based on this modified data set. Dissert. Abstr.

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N78-23866 Rutgers - The State Univ., New Brunswick, N. J.
CHARACTERISTIC SUBSPHERES OF DIFFERENTIABLE GROUP ACTIONS ON HOMOTOPY SPHERES Ph.D. Thesis
Valdis Vijums 1977 51 p
Avail: Univ. Microfilms Order No. 7805138

The existence of characteristic subspheres of finite group actions on spheres are studied. The main results are: (1) (Semifree actions) Under certain dimension restrictions and restrictions on the representation at the fixed point set, every semifree action on a homotopy sphere, with fixed point set also a homotopy sphere, has a characteristic subsphere provided the order of the group is odd and in some cases if the group is cyclic of even order. Otherwise, we need to take a finite multiple of the sphere to get a characteristic subsphere. (2) (Arbitrary actions) Under similar dimension restrictions and similar restrictions on the representation at the fixed point set, up to a finite multiple, every action on a homotopy sphere is equivalent to one which has a characteristic subsphere. Dissert. Abstr.

N78-23867 Texas Univ., Arlington.
EXISTENCE THEORY OF DIFFERENTIAL EQUATIONS IN ABSTRACT SPACES RELATIVE TO THE WEAK AND K-NORM TOPOLOGIES Ph.D. Thesis
Evin Joyce Cramer 1977 48 p
Avail: Univ. Microfilms Order No. 7804997

The study of the Cauchy problem for differential equations in a Banach space relative to the strong topology has been of particular interest from an applied point of view since partial differential equations can be expressed as ordinary differential equations in appropriate Banach spaces. Some alternatives to the strong topology are discussed. One alternative is to look at the weak topology. Existence results are proved in arbitrary Banach spaces using a weak compactness condition in terms of a measure of weak noncompactness. Similar results are obtained using a weak dissipative condition. Using these existence results, comparison results relative to the weak topology are also proved. Another alternative is to use a cone valued norm and the corresponding idea of a K-Banach space. Both polygonal and successive approximations are used to obtain existence results in K-Banach spaces under a variety of hypotheses.
Dissert. Abstr.

N78-23868# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Computer Sciences.
SSOR PRECONDITIONING OF TOEPLITZ MATRICES Ph.D. Thesis
Lennart Andersson 1976 92 p refs
(CTH-76.02-R) Avail: NTIS HC A05/MF A01

The rate of convergence of the conjugate gradient method, when used to iteratively solve a linear system of equations AU = f where A is a real symmetric positive definite matrix of order n, is shown to be improvable by SSOR (symmetric successive over-relaxation) preconditioning of the matrix A. The matrix is then assumed to be Toeplitz type, triangular or not. An upper bound for the spectral radius of the SOR (successive over-relaxation) matrix is found so that some of the results found for the SSOR are pertinent to the SOR iterative method. The distribution of eigenvalues of the preconditioned Toeplitz matrix is shown to include a few large isolated eigenvalues. Applications to elliptic differential equations are given together with numerical experiments with solving finite element approximations of the Poisson equation in the plane. ESA

N78-23869# Danish Meteorological Inst., Copenhagen.
THE BASIC VECTOR FIELD EQUATIONS WRITTEN IN THREE ORTHOGONAL CURVLINED COORDINATE SYSTEMS, SUITED FOR METEOROLOGY
Kirsten Carlsen 1976 59 p refs
(DMI-Medd-26; ISBN-87-7478-125-1) Avail: NTIS HC A04/MF A01

The new reference ellipsoid is made the basis for an orthogonal ellipsoidal coordinate system, usable for all geophysical categories, but especially well designed for meteorology. This system allows exact treatments not only of scalar, but also of vector point functions. Tensor calculus is exact and therefore preferred, mostly in the dyadic form, and the absolute differential calculus, made by Ricci and Levy-Civita, is also applied. The boundary problems are treated by means of empirical functions in tensorial form. Author (ESA)

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N78-23870 City Univ. of New York.
SPECIFIC HEAT OF SUBMONOLAYER HELIUM FILMS ADSORBED ON ARGON COATED GRAFOIL Ph.D. Thesis
Christos Nikos Koutsogeorgis 1978 200 p
Avail: Univ. Microfilms Order No. 7805765

Measurements were made of the specific heat of submonolayer He-3 and He-4 films, absorbed on Grafoil precoated with a monolayer of Argon. The He-4 measurements were made in the temperature range of 0.4 to 4.2 K for areal densities D equal to 0.008, 0.015, 0.022, 0.029, 0.035, 0.040 and 0.043 A to the minus 2 power. The He-3 measurements were made in the temperature range of 0.8 to 6.0 K. The densities studied were 0.012, 0.024, 0.035, 0.045, 0.056 A to the minus 2 power on an Argon coating of 1% less than the Argon monolayer (as determined at 77.3 K). and 0.023, 0.045, 0.073 A to the minus 2 power on an Argon coating of 5% more than the monolayer. The resulting He-4 curves, with the exception of D equal to 0.008 A to the minus 2 power, showed marked peaks, reaching values of reduced specific heat C/Nk of 2.5 to 3.6 in the temperature range of 1.95 to 2.55 K. The temperature of the peaks increased with density. Dissert. Abstr.

N78-23871# National Physical Lab., Teddington (England).
DETERMINATION OF THE AMPERE AND OF THE GYROMAGNETIC RATIO OF THE PROTON
P. Vigoureux and N. Dupuy Jan. 1978 15 p refs
(NPL-DES-44) Avail: NTIS HC A02/MF A01

Realization of the ampere by means of the current balance, and measurements of the gyromagnetic ratio of the proton in a weak magnetic field, over the last fifteen years, are reviewed. The latest measurements with the current balance suggest that the unit of current A sub BI 77 maintained at the International Bureau of Weights and Measures (BIPM) exceeds the ampere by nearly 8 in 1 million. The value obtained for the gyromagnetic ratio of the proton in a weak field, taken in conjunction with Kibble and Hunt's measurement, in a strong field, would however make A sub BI 77 lower than the ampere by nearly 10 in 1 million. Author (ESA)

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N78-23872 Rensselaer Polytechnic Inst., Troy, N. Y.
ANALYSIS OF THE EFFECTS OF SELECTED ENVIRONMENTAL VARIATIONS ON UNDERWATER ACOUSTIC FLUCTUATIONS Ph.D. Thesis
James Albert Widtfeldt 1977 152 p
Avail: Univ. Microfilms Order No. 7802866

The effects of selected variations in the ocean environment on underwater sound transmissions are explored mathematically, and theoretical results are compared with experimental data when possible. A unified treatment of conical ray path, corresponding to a class of nonlinear sound speed dependences on ocean depth is presented. A treatment is presented of total-field phase fluctuations of a CW signal, transmitted across a slowly varying northward geostrophic flow. The results of an earlier hydrodynamical study by other investigators of a uniform, deep-ocean flow are used to develop simple approximations to the sound-speed and current distributions in the flow. The behavior of sound speed with depth, surface current, and source and receiver locations is examined. Dissert. Abstr.

N78-23873 California Univ., Los Angeles.
NON-LINEAR, PARAMETRIC GENERATION OF SOUND BY RESONANT MODE CONVERSION Ph.D. Thesis
Steven Lurie Garrett 1977 197 p
Avail: Univ. Microfilms Order No. 7806481

When nonlinear terms are included in the two fluid hydrodynamic descriptions of superfluid helium-4, first sound (pressure-density waves) and second sound (temperature-entropy waves) are coupled. The interaction of two second sound waves to produce a propagating first sound wave is shown to occur at a specific angle which makes the point of intersection of the second sound waves travel at the speed of first sound. The growth of the mode converted first sound wave is calculated with and without attenuation of the primary (second sound) waves from 1.2 K to 2.15 K and from saturated vapor pressure to twenty atmospheres. An experiment to observe this mode conversion process in a waveguide to rectangular cross-section is described. Dissert. Abstr.

N78-23874 Catholic Univ. of America, Washington, D. C.
SPATIAL IMPULSE RESPONSE OF AN ACOUSTIC LINE RADIATOR: A STUDY OF BOUNDARY-DIFFRACTION-WAVE PHENOMENA AND THEIR EXPERIMENTAL DETECTION Ph.D. Thesis
Anthony Joseph Rudgers 1978 238 p
Avail: Univ. Microfilms Order No. 7806925

A time-domain, description of the acoustic field of a finite line source (expressed by the source's spatial impulse response function) was derived to detect the presence, of a geometrical wave and of two boundary diffraction waves in that field and to study the properties of these component waves. The theoretical model was tested experimentally by measuring the spatial impulse response function of a line transducer. The acoustic experiments were conducted in a large water tank, using bursts of bandlimited, pseudorandom, white, Gaussian noise to excite the source transducer electrically. By crosscorrelating these electrical signals with the acoustic signals that line transducer radiates, and by using a computer to filter the resulting cross-correlation functions, the waveform of the source transducer's spatial impulse response is obtained at a number of different observation points in the transducer's acoustic field. Dissert. Abstr.

N78-23875*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NOISE PREDICTION TECHNOLOGY FOR CTOL AIRCRAFT
John P. Raney May 1978 16 p refs Presented at the CTOL Transport Tech. Conf., Hampton, Va., 28 Feb. - 3 Mar. 1978
(NASA-TM-78700; L-12234) Avail: NTIS HC A02/MF A01 CSCL 20A

The application of a new aircraft noise prediction program to CTOL noise prediction is outlined. Noise prediction is based on semiempirical methods for each of the propulsive system noise sources, such as the fan, the combustor, the turbine, and jet mixing, with noise-critical parameter values derived from the thermodynamic cycle of the engine. Comparisons of measured and predicted noise levels for existing CTOL aircraft indicate an acceptable level of accuracy. Author

N78-23876*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HIGH FREQUENCY SOUND ATTENUATION IN SHORT FLOW DUCTS
J. W. Posey May 1978 25 p refs Presented at the 95th Meeting of the Acoust. Soc. of Am., Providence, 16-19 May 1978
(NASA-TM-78708) Avail: NTIS HC A02/MF A01 CSCL 20A

A geometrical acoustics approach is proposed as a practical design tool for absorbent liners in such short flow ducts as may be found in turbofan engine nacelles. As an example, a detailed methodology is presented for three different types of sources in a parallel plate duct containing uniform ambient flow. A plane wave whose wavefronts are not normal to the duct walls, an arbitrarily located point source, and a spatially harmonic line source are each considered. Optimal wall admittance distributions are found, and it is shown how to estimate the insertion loss for any admittance distribution. The extension of the methodology to realistic source distributions in variable area cylindrical or annular ducts containing arbitrary flow is shown to be conceptually straightforward and computationally practical on a vector-hardware digital computer. Author

N78-23877*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

NOISE TRANSMISSION THROUGH PLATES INTO AN ENCLOSURE M.S. Thesis - George Washington Univ.

Wayne B. McDonald (Joint Inst. for Advancement of Flight Sciences, Washington, D. C.), Rimas Vaicaitis, and Michael K. Myers (Joint Inst. for Advancement of Flight Sciences, Washington, D. C.) May 1978 44 p refs

(NASA-TP-1173; L-11906) Avail: NTIS HC A03/MF A01 CSCL 20A

An analytical model is presented to predict noise transmission through elastic plates into a hard-walled rectangular cavity at low frequencies, that is, frequencies up through the first few plate and cavity natural frequencies. One or several nonoverlapping and independently vibrating panels are considered. The effects on noise transmission of different external-pressure excitations, plate boundary conditions, fluid parameters, structural parameters, and geometrical parameters were investigated. Author

N78-23878# Naval Ship Research and Development Center, Bethesda, Md.

A GUIDE TO THE USE OF THE XWAVE PROGRAM. PART 2: SCATTERING OF SOUND WAVES FROM RIGID STRUCTURAL SURFACES

Francis M. Henderson Feb. 1978 95 p refs

(SF53532020)

(AD-A052093; DTNSRDC-78/019-Pt-2) Avail: NTIS HC A05/MF A01 CSCL 20/1

This report reviews a generalized formulation of the steady-state boundary value problem for scattering of infinite plane waves by an arbitrary closed rigid surface immersed in an infinite fluid. The normal velocity distribution generated over the closed surface by scattering of plane waves can also be interpreted as the boundary condition of an equivalent steady-state radiation problem. The numerical solution of rigid surface scattering problems is therefore obtainable by a simple extension of capabilities of the XWAVE program. The additional data required by XWAVE for rigid-surface scattering applications and several sample calculations are presented. Author (GRA)

N78-23879# Army Construction Engineering Research Lab., Champaign, Ill.

ROTARY-WING AIRCRAFT OPERATIONAL NOISE DATA Final Report

Brian Homans, Lincoln Little, and Paul D. Schomer Feb. 1978 72 p refs

(DA Proj. 4A7-62720-A-896)

(AD-A051999; CERL-TR-N-38) Avail: NTIS HC A04/MF A01 CSCL 20/1

This report presents Sound Exposure Level (SEL) vs distance curves for eight models of Army rotary-wing aircraft (OH-58, AH-1G, UH-1M, UH1-1H, UH-1B, CH-47B, CH-54, and TH-55) performing dynamic operations, and Equivalent Sound Level contours for the same aircraft in static operations. The dynamic operations consisted of level flyovers, ascents, descents, turns, takeoffs, and landings; static operations included in-ground and out-of-ground effect hovers. Results are grouped according to model and type of operation and are suitable for use in manual or computerized programs for predicting noise impact from rotary-wing aircraft. Author (GRA)

N78-23880# Catholic Univ. of America, Washington, D. C. Dept. of Physics.

MODAL AND SURFACE WAVE RESONANCES IN ACOUSTIC-WAVE SCATTERING FROM CAVITIES Technical Report, 1 Nov. 1976 - 31 Oct. 1977

H. Ueberall 21 Oct. 1977 58 p refs

(Contract N00014-76-C-0430; RR0110801)

(AD-A051162) Avail: NTIS HC A04/MF A01 CSCL 20/1

The problems of the scattering of waves from an obstacle, no matter in which field of physics they are being considered, exhibit an essential similarity. This similarity extends from the scattering of sound waves by an elastic object (acoustics) over elastic wave scattering from a cavity (geophysics and materials testing) to the problems of particle scattering from particles and nuclei (high energy and nuclear physics). While historically, progress has been made along different lines in the various fields, it has become clear that more may be learned by applying the methods of one field of physics in another one, and vice versa, so that the basic similarities of the scattering problem may be exhibited and exploited. The Breit-Wigner resonance scattering formalism of nuclear physics is applied to both acoustic and elastic wave scattering (essentially another way of exhibiting the Regge poles), and relate the resonances to the eigenvibrations of the scattering object. GRA

N78-23881# Southampton Univ. (England). Inst. of Sound and Vibration Research.

JET NOISE MODELLING BY GEOMETRIC ACOUSTICS. PART 1: THEORY AND PREDICTION OUTSIDE THE CONE OF SILENCE

C. L. Morfey and V. M. Szewczyk Sep. 1977 174 p refs Sponsored by Natl. Gas Turbine Estab., Pyestock, Engl. 3 Vol.

(ISVR-TR-91-Pt-1) Avail: NTIS HC A08/MF A01

The generation of noise by the turbulent mixing process downstream of a round jet nozzle is investigated and a geometric acoustics model for jet noise radiation outside the cone of silence is developed. For isothermal jets the turbulence is represented as acoustically equivalent to a volume displacement distribution of quadrupole order. For non-uniform density flows (heated jets) the dominant radiation at low Mach numbers is modeled as acoustically equivalent to a volume displacement distribution of dipole order. A volume displacement monopole distribution is also considered as a possible additional source of noise in heated jets. The effect of mean flow-acoustic interaction is modeled separately from the sources. Source non-compactness and convection effects are included in the source description. A jet noise prediction scheme valid for radiation angles outside the cone of silence is developed from the source master spectra and turbulence parameters inferred from rear arc jet noise measurements, using the geometric acoustics model. Agreement between predictions in the forward arc and measured results is very good. Author (ESA)

N78-23882# Southampton Univ. (England). Inst. of Sound and Vibration Research.

JET NOISE MODELLING BY GEOMETRIC ACOUSTICS. PART 2: THEORY AND PREDICTION INSIDE THE CONE OF SILENCE

C. L. Morfey and V. M. Szewczyk Oct. 1977 84 p refs Sponsored by Natl. Gas Turbine Estab., Pyestock, Engl. 3 Vol.

(ISVR-TR-92-Pt-2) Avail: NTIS HC A05/MF A01

A geometric acoustics model of jet mixing noise is extended to describe far-field radiation within the cone of silence. The relevant acoustic-mean flow interactions are modeled by an approximation to the WKB type solution. The original monopole solution is generalized to yield high-frequency solutions for the dipole and quadrupole sources used to model jet mixing noise. The exponential decay factor encountered within the cone of silence is theoretically predicted to be almost proportional (in decibels) to the shear layer thickness. Analysis of a wide range of isothermal jet noise data leads to inferred values of the ratio of shear layer thickness at the source location to the nozzle diameter, as a function of Strouhal number. These are in excellent agreement with the results of source location and flow profile measurements. Author (ESA)

N78-23883# Southampton Univ. (England). Inst. of Sound and Vibration Research.

JET NOISE MODELLING BY GEOMETRIC ACOUSTICS. PART 3: A COMPUTER PROGRAM FOR THE PREDICTION OF JET MIXING NOISE

C. L. Morfey and V. M. Szewczyk Oct. 1977 29 p Sponsored by Natl. Gas Turbine Estab., Pyestock, Engl. 3 Vol.

(ISVR-TR-93-Pt-3) Avail: NTIS HC A03/MF A01

A prediction program for far-field jet mixing noise is documented. The theory is based upon Morfey's geometric acoustics model of jet mixing noise. The program is valid for radiation angles greater than 30 deg to the jet axis and for any jet static temperature ratio. Any velocity ratio may be predicted outside the cone of silence, but there is at present an upper limit inside the cone of silence. Sound pressure levels in 1/3 octave bands are predicted for a source Strouhal number range of 0.1 to 3.16, corresponding to a frequency range of 5 octaves centered approximately on the peak 1/3 octave frequency. Author (ESA)

N78-23884# Southampton Univ. (England). Inst. of Sound and Vibration Research.
MEASUREMENTS WITH AN INTENSITY METER OF THE ACOUSTIC POWER OF A SMALL MACHINE IN A ROOM
F. J. Fahy Sep. 1977 27 p refs
(ISVR-TR-94) Avail: NTIS HC A03/MF A01

A technique which employs two closely spaced pressure microphones, a special purpose circuit, and a sound level meter to measure acoustic intensity in octave bands, is used to estimate the intensity distribution around a small, 1200 electrical watt, machine situated in a room. The total acoustic power estimated therefrom is compared with that obtained by the conventional direct field method. The technique, which appears to be accurate over the range 250-4000 Hz, produces values of intensity and power which are generally less than the direct field values. The difference tends to increase with frequency. A potential for source location application is indicated. Author (ESA)

N78-23885# National Physical Lab., Teddington (England).
PRACTICE AND PRINCIPLE IN ENVIRONMENTAL NOISE RATING
D. W. Robinson Apr. 1977 24 p refs
(NPL-Ac-81) Avail: NTIS HC A02/MF A01

The possibility to derive a comprehensive noise index was studied to abandon established practices. Some classes of noise evaluation and planning problems are soluble only within a unified system. These are outlined, together with brief reviews of progress on standardization in UK, USA, and ISO. The scale of noise measurement on which such progress is possible is the A-weighted equivalent continuous sound level, Leq. This is not an ideal quantity though its physical properties are attractively simple. The principles which underlie the concept of a unified noise index are outlined and a brief account is given of possible future developments. Experimental work will be needed to determine the direction which these should take, bearing in mind that there are conflicting factors of complexity and faithfulness to the purpose, that is, to represent community reaction in numerical terms. It is argued that the scientific principles can best be studied in a program of laboratory experiments, while the determination of acceptability levels must entail field work and surveys. Author (ESA)

N78-24034# Joint Publications Research Service, Arlington, Va.
INVESTIGATING THE EXCITATION OF ACOUSTIC WAVES IN PLATES
V. V. Burliy, I. Ya. Kucherov, I. V. Ostrovskiy, and V. M. Pergal *In its* Transl. on USSR Sci. and Technol. (JPRS-71181) 25 May 1978 p 17-22 refs Transl. into ENGLISH from Izv. Vysshykh Uchebn. Zavedenii Radioelektron. (Kiev), vol. 21, no. 3, 1978 p 25-28 (For availability see N78-24033 14-99)
Copyright. Avail: Issuing Activity

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N78-23886 Johns Hopkins Univ., Baltimore, Md.
PRODUCTION OF ELECTRONS WITH ENERGY GREATER THAN 50 keV BY HEAVY ION-ATOM COLLISIONS Ph.D. Thesis
Joseph Albert McClintock 1978 111 p
Avail: Univ. Microfilms Order No. 78-06261

Cross sections were measured for the production of electrons with kinetic energies from 50 to 150 keV by heavy ion-atom collisions. The beams of 40 and 70 MeV nickel and 70 and 120 MeV bromine ions were produced by a tandem Van de Graaff accelerator and were incident on targets of carbon, nickel, potassium bromide, silver and gold. The energy spectra were measured using a steering electron spectrometer capable of 7% transmission and 4 keV resolution. The observed cross sections were compared with the predictions of the plane wave Born approximation with particular attention to the variation of cross section with respect to the electron energy. In the electron energy region observed the cross sections exceed the Born predictions by factors of 2 to 10 with deviation becoming more pronounced at high electron energy. Dissert. Abstr.

N78-23887 Southern Illinois Univ., Carbondale.
INFRARED AND RAMAN SPECTRA OF AMINO ACID MONOMERS, DIMERS AND POLYMERS Ph.D. Thesis
Krishnan Balagopalan 1977 107 p
Avail: Univ. Microfilms Order No. 7804279

The nature of molecular vibrations in amino acid monomers, dimers and polymers in solid phase was investigated. The far infrared spectra at 300 K and 100 K was measured for both the alpha, beta, forms for the biopolymer Poly-L-Alanine and Poly-L-Leucine (alpha). The observed data are interpreted in terms of theoretical calculations on the isolated chain. The conformation, intramolecular, and intermolecular forces are discussed. The infrared, far infrared and Raman spectra of monomers L-Isoleucine and L-Leucine having the same chemical formula but of different primary structures are examined as well as those of dimers Di-L-Alanine and L-Alanyl-L-Leucine in solid phase at 300 K and 100 K. Tentative assignments for the modes of vibration were made for L-Alanyl-L-Leucine and compared with Di-L-Alanine. Dissert. Abstr.

N78-23888 Pittsburgh Univ., Pa.
THEORETICAL STUDIES OF MULTIPHOTON PROCESSES-RESONANCE FLUORESCENCE IN INTENSE FIELDS Ph.D. Thesis
Shoou-Dyi D. Yeh 1977 117 p
Avail: Univ. Microfilms Order No. 78-01899

The resonance fluorescence spectra of two-level and three-level systems, and the absorption spectrum of a two-level system illuminated by an intense light beam are studied using a Green's function approach. The Green's function method involves the use of projection operators onto subspaces of the Hilbert space. The off-diagonal parts of the Green's function can be written as products of diagonal ones, and the diagonal parts are expressed in terms of continued fractions. Some new features in the three-level spectrum emerge, which may explain the asymmetries observed in the experiments. The applicability of this approach to various problems is also demonstrated in the calculation of the Bloch-Siegert shift where only a single-mode field is involved, as well as in the calculation of the amplification/attenuation spectrum where many modes are involved. Dissert. Abstr.

N78-23889 Johns Hopkins Univ., Baltimore, Md.
LABORATORY AND AURORAL STUDIES OF MOLECULAR NITROGEN Ph.D. Thesis
Edward Joseph Beiting, III 1978 192 p
Avail: Univ. Microfilms Order No. 78-06235

Infrared and ultraviolet spectra of molecular nitrogen were obtained using a Czerny-Turner spectrograph which was converted to spectrometric operation by using a lead screw scanner to translate an exit slit focused onto a cooled intrinsic germanium photodiode detector. A rotational analysis for the 27 branches of the band studied was carried out on the 482 rotational lines identified as part of the band. Near ultraviolet spectra of an IBC II+ aurora was obtained by rocket-borne Ebert-Fastie monochromator with 15 A resolution. The 2000-2800 A wavelength range permitted relative altitude profiles of the first eight progressions of the nitrogen Vegard-Kaplan system, the delta v=8 sequence of the Lyman-Birge-Hopfield system, and a band attributed to the Herman-Kaplan system to be measured. A synthetic spectrum aided in identification of all features observed in this wavelength interval, and exceptional agreement was achieved using laboratory measured transition probabilities. Dissert. Abstr.

N78-23890*# Pennsylvania State Univ., University Park. Electrical Engineering Dept.
ION TRACKING IN AN ELECTROSTATIC POTENTIAL DISTRIBUTION Ph.D. Thesis
David P. Ross May 1978 57 p refs
(Grant NsG-3166)
(NASA-CR-156983) Avail: NTIS HC A04/MF A01 CSCL 20H

An ion tracking system utilizing a single detector was designed to resolve two dimensional potential distributions in a vacuum. The ion detector consisted of a continuous dynode electron

multiplier tube mounted behind a series of aperture plates. The detector was located on a track below a wedge shaped structure used to produce the desired potential distribution. A 150 volt electron beam aimed at selected regions, ionized the residual gas in the chamber. The ions were ejected from their source points by electrostatic forces causing them to drift downward toward the detector. Measurements of particle energy, detector position, and entry angle of the incoming particle flux were used to initialize a computer trajectory-tracing program. The program assumes a known theoretically calculated potential distribution near the wedge for computation of particle trajectories, providing a basis for evaluating the data. Special attention was given to characterization of the ion detector. Author

N78-23891# Brown Univ., Providence, R. I. Dept. of Chemistry.

FAR INFRARED STUDIES OF ION CLUSTERING IN ISOMERS

George B. Rouse, Andreas T. Tsatsas, Adi Eisenberg, and William M. Aisen, Jr. 26 Dec. 1977 19 p refs Submitted for publication

(Contract N00014-75-C-0883)

(AD-A051894; TR-77-03) Avail: NTIS HC A02/MF A01 CSCL 20/8

Direct evidence for the existence of ion clusters in ionomers has been found through the investigation of the far infrared spectra of (PSMA) alkali metal ionomers of polystyrene methacrylic acid measured as a function of ionic content. The Co existence of two kinds of cation-containing environments, multiplets and clusters, has been shown for sodium PSMA ionomers, in which the two must be present simultaneously above 3.9 mole % of ionic groups. GRA

N78-23892# Ohio State Univ., Columbus. Dept. of Welding Engineering.

CONTROL OF SPIKING IN PARTIAL PENETRATION OF ELECTRON BEAM WELDS Final Report, 1 Oct. 1969 - 1 Oct. 1976

15 Nov. 1976 161 p refs

(Contract W-7405-eng-26)

(Y/SUB-3347/1) Avail: NTIS HC A08/MF A01

An investigation of the penetration mechanism of high energy density electron beams and an evaluation of electron beam deflection as a method of penetration control are presented. A discussion of electron beam mechanics including several penetration theories is presented in the introduction and background. Slur radiographs made using a pinhole X-ray camera are evaluated to determine velocity and acceleration of the point of beam impingement. Methods of cavity closure are discussed with possible causes of surface sealing of the beam cavity. A method of penetration, after the cavity has closed, based on the curves relating velocity and acceleration to penetration distance is considered. An estimate of cavity pressure is made from the maximum acceleration of the beam-metal interface. A system using an X-ray detector coupled with a beam deflecting device is detailed and evaluated. Based on several specimens which are presented beam deflection appears capable of controlling penetration depth. ERA

N78-23893# California Univ., Berkeley. Lawrence Berkeley Lab.

CHEMICAL APPLICATIONS OF MOLECULAR QUANTUM THEORY Ph.D. Thesis

Steven Ray Ungemach Sep. 1977 158 p refs

(Contract W-7405-eng-48)

(LBL-6699) Avail: NTIS HC A08/MF A01

The self-consistent field (SCF) method is used to predict the molecular structures of ClF2, ClF4 and Cl3 radicals, and the ions ClF2(+), ClF2(-), ClF4(+) and ClF4(-). The ClF2 and Cl3 radicals are predicted to be bent with bond angles of 145.2 deg and 158.6 deg, respectively, while the ions ClF2(+) and ClF2(-) are predicted to be bent with a bond angle of 97.4 deg and linear, respectively. The geometry predictions for the ClF4 radical and the ClF4(+) ion are found to be notably basis set dependent. The ClF4(-) ion is predicted to be square-planar. Multiconfiguration self-consistent field calculations yielded the dipole moment function for the 1sigma(+) state of HI, which qualitatively confirms the experimental finding that the dipole derivative at R/sub e/ is negative. The 2sigma(+)F + H2 potential energy surface is studied extensively with the configuration interaction method. The simplest hydrophobic model, the water-methane system, is studied with the SCF method in order to determine the nature and magnitude of the interaction. ERA

N78-23894# Argonne National Lab., Ill.

EFFECTS SEEN IN THE INTERACTIONS OF FAST MOLECULAR-ION BEAMS WITH MATTER

D. S. Gemmell, P. J. Cooney, W. J. Pietsch, A. J. Ratkowski, Z. Vager, B. J. Zabransky, A. Faibis, G. Goldring, and I. Levine 1977 66 p refs Presented at 7th Intern. Conf. on Atomic Collisions in Solids, Moscow, 19-23 Sep. 1977

(Contract W-31-109-eng-38)

(CONF-770931-4) Avail: NTIS HC A04/MF A01

Experimental results are presented from high resolution studies of the energy and angle distributions for the break-up products that arise from the dissociation of a variety of fast molecular ions in thin carbon foils and in gases. The results for foil targets are compared with calculations based on a model for the polarization wakes induced in foils by the passage of fast charged projectiles. An example is given of the application of this type of dissociation measurement to the determination of a molecular structure--that of H3+. Also measurements on the transmission of fast molecular ions through carbon foils are described and results presented on the transmission probabilities, energy losses and angular distributions of the transmitted ions. ERA

N78-23895# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

EXPERIMENTAL AND THEORETICAL INVESTIGATIONS OF DELTA J- AND DELTA M-TRANSITIONS BY SMALL ANGLE SCATTERING OF POLARIZED CsF MOLECULES WITH ATOMS AND MOLECULES Ph.D. Thesis - Goettingen Univ., West Ger. [EXPERIMENTELLE UND THEORETISCHE UNTERSUCHUNGEN VON DELTA J- UND DELTA M-UEBERGAENGEN DURCH KLEINWINKELSTREUUNG UND POLARISIERTEN CsF MOLEKUELEN MIT ATOMEN UND MOLEKUELEN]

Ulrich Borkenhagen Jul. 1977 145 p refs In GERMAN

(MPIS-1/1977) Avail: NTIS HC A07/MF A01; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 23,55

A scattering experiment is described in which absolute inelastic collision cross sections were measured for transitions between defined (J,M) rotation states of CsF in collisions with atoms and molecules. The improved resolving power of the equipment allowed a relatively accurate measurement even of the very small inelastic rotation cross sections for collisions with rare gas atoms. The nearly full polarization of the CsF beam allowed observation of the Delta M transitions of the CsF molecule. The target was a nozzle jet, in order to take advantage of the polarization of the CsF beam. An extensive Monte Carlo simulation of the experiment was carried out in order to account for the resolution of the equipment. Differential cross sections were calculated for the relevant transitions using a simple model. ESA

N78-23896# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.

SET-UP OF AN ALPHA SPECTROMETRY SYSTEM

A. Calicchia 22 Nov. 1976 14 p refs In ITALIAN; ENGLISH summary

(ISS-T-76/14) Avail: NTIS HC A02/MF A01

The principles of operation of an alpha particle spectrometry system, using a silicon solid state detector, is described. The spectrometer allows precise determination of the sample's activity and specifies the alpha-emitting radionuclides. Measurements to determine the system performance, i.e. the energy resolution and the real sensitivity, are presented. ESA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N78-23897 California Univ., Santa Barbara.
MEASUREMENTS OF THE PHOTON TOTAL CROSS SECTION ON PROTONS FROM 45 Gev TO 182 Gev Ph.D. Thesis
John Perry Cumalat 1977 199 p
Avail: Univ. Microfilms Order No. 78-07021

The photon total cross section on protons was measured from 45 Gev to 182 Gev to 1% statistical accuracy in each energy bin and to less than 0.7% systematic uncertainty overall. The cross section was found to be gently rising with increasing incident photon energy. Although the rise in the cross section was gentle, only 4% over the measured energy range, the cross section sloped upward more rapidly than would be predicted by simple Vector Meson Dominance models. Moreover, the magnitude of the cross section was 2%-4% larger than expected. Both the unexpected magnitude and rise of the photon total cross section are attributed to the photon strongly coupling to states of charm-anticharm quarks. Dissert. Abstr.

N78-23898# Air Force Systems Command, Wright-Patterson AFB, Ohio.
CHARGING DIELECTRICS WITH A BEAM OF CHARGED PARTICLES
A. A. Vorobyev, O. B. Yevdokimov, and V. N. Guselnikov 23 Aug. 1977 13 p Transl. into ENGLISH from Radiatsionnaya Fiz. Nemetallicheskikh Kristallov (USSR) v. 3, 1971 p 131-138
(AD-A051477; FTD-ID(RS)T-1448-77) Avail: NTIS HC A02/MF A01 CSCL 20/3

The interest in the charging of macroscopic particles of matter has grown in recent years. This is connected with the desire to accelerate macroscopic particles to high velocities with the goal of modelling the behavior of micrometeorites, and initiating thermonuclear fusion. In addition, charged macroscopic particles are used as fuel in reactive electrostatic motors. The means usually used in charging macroscopic particles impart to them a surface charge. The development of acceleration technology has made it possible, in recent years, to give a volume charge to dielectrics, through irradiation by fast electrons or gamma rays. This method allows one to charge the entire volume of a dielectric with cross-sectional area up to several square centimeters. The charge deposited within the dielectric by this method can be so large that discharge, or even spallation, sets in rapidly. GRA

N78-23899# Los Alamos Scientific Lab., N. Mex.
REACTOR TECHNOLOGY Progress Report, Apr. - Jun. 1977
John L. Warren, comp. Aug. 1977 50 p refs
(Contract W-7405-eng-36)
(LA-6931-PR) Avail: NTIS HC A03/MF A01

Progress is reported in eight program areas. Steady progress was made on defining the design of space electric power supply components. There were three significant advances in heat pipe technology. Criteria were set forth for the selection of compatible combinations of ceramics and metal coats for heat pipes. A system to avoid molecular absorption of the laser light in sodium vapor lasers was devised and tested. A mercury heat pipe to remove heat from stored fuel elements is being fabricated. Work continues on the evaluation of computer codes used in the analysis of gas-cooled nuclear reactors to be used for nuclear process heat. Work is nearly complete on a model of a gas core reactor power plant. Criticality experiments are being run in the plasma core critical assembly. Several other critical assemblies are in routine use for verifying calculations and supporting research being done by other groups in the laboratory. ERA

N78-23900# Department of Energy, Washington, D. C. Div. of Magnetic Fusion Energy.
PERSPECTIVES ON THE DEVELOPMENT OF FUSION POWER BY MAGNETIC CONFINEMENT, 1977
1977 7 p
(DOE/ET/0002) Avail: NTIS HC A02/MF A01

The Committee concludes: that recent progress of the magnetic fusion energy program provides a tangible basis for the belief that the development of fusion power will prove feasible; that the primary near-term objective of the program should now be to demonstrate actual reactor-level conditions; and that the potential long-term benefits of fusion power are sufficiently great to warrant a sustained national effort to advance the fusion power option to the stage of commercial availability at an early time. ERA

74 OPTICS

Includes light phenomena.

N78-23901 Catholic Univ. of America, Washington, D. C.
INTENSITY FLUCTUATIONS OF A LIGHT BEAM PROPAGATED BEYOND A THIN TURBULENT LAYER Ph.D. Thesis
Charles Joseph Infosino 1978 168 p
Avail: Univ. Microfilms Order No. 78-05731

General analytic relationships were developed to relate the far-field irradiance fluctuations and the spectrum of these fluctuations to the statistical parameters used to characterize a turbulent phase screen. Emphasis was placed on finding a solution for the strong phase screen case, for which the mean-squared phase is much greater than one. First, analytic expressions for the spectra associated with infinite plane waves were developed. The results were applied to a particular case of propagation of optical waves through high altitude turbulent index of refraction layers in the atmosphere and then to the propagation of radio waves through the ionosphere. The effect of the size of the beam relative to the turbulence scale L was investigated in some detail. The effect of beam size on the irradiance fluctuations spectra was investigated. Dissert. Abstr.

N78-23902 Arizona Univ., Tucson.
AN INTERFEROMETRIC TUNABLE OPTICAL FILTER FOR SOLAR STUDIES Ph.D. Thesis
Francisco Martim Smolka 1977 169 p
Avail: Univ. Microfilms Order No. 7804903

The proposed instrument utilizes ten Michelson type interferometers in a Lyot-Ohman filter configuration with stage duplication. The claims are sustained by some very detailed calculations of the filter's properties. Those calculations are applied to the use of the filter in a f/100 solar telescope, but some of the results can be extended to any other optical system. Also, a large section of this work is devoted to the frustrated total internal reflection, its theoretical analysis and applications in the construction of beamsplitters. This work contains a review of the main instruments used in optical spectroscopy. A brief presentation of the main characteristics of the solar spectrum is also included as well as a proposal for a specific experiment that could give the line to continuum opacity ratio of weak solar absorption Fraunhofer lines. Dissert. Abstr.

N78-23903*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CALIBRATION ANALYSIS FOR A MULTI-CHANNEL INFRARED SCANNING RADIOMETER
Harvey Walden, Edward J. Hurley, and C. Laurence Korb Dec. 1977 69 p refs
(NASA-TM-78058) Avail: NTIS HC A04/MF A01 CSCL 20F

A procedure for calibrating an infrared scanning spectroradiometer by a computerized parametric error analysis technique was developed. The uncertainties in the radiometric measurements of scene radiance and (for the case of a blackbody scene) temperature due to possible uncertainties in the calibration target temperature, calibration target emissivity, and instrument temperature were calculated for a range of uncertainty levels in the parameters, as well as for a gamut of scent temperatures corresponding to a given spectral channel. This technique is applicable to the radiometric calibration of any infrared radiometer. It was applied specifically to the Cloud-Top Scanning (C.T.S) Radiometer, a three-channel instrument designed for aircraftborne

cloud radiance measurements in the 6.75 and 11.5 micron thermal emission spectral regions. Author

N78-23904# Laser Diode Labs., Inc., Metuchen, N. J.
LIGHT EMITTING DIODES FOR FIBER OPTIC COMMUNICATIONS Quarterly Report, 1 Apr. - 30 Jun. 1977
Albert Gennaro 21 Nov. 1977 29 p
(Contract DAAB07-76-C-8135)
(AD-A051791; QR-3) Avail: NTIS HC A03/MF A01 CSCL 09/1

The design and fabrication of high speed etched-well light emitting diodes for fiber optic communications is discussed with regard to materials synthesis via LPE, wafer fabrication, and device assembly in a manufacturing environment. Author (GRA)

N78-23905# Eikonix Corp., Burlington, Mass.
HIGH RESOLUTION OPTICAL POWER SPECTRUM ANALYZER Final Report, 2 Feb. - 2 Dec. 1977
N. Balasubramanian and P. S. Considine 31 Jan. 1978 84 p refs
(Contract DAAK70-77-C-0046)
(AD-A051845; EC/2106801-FR; ETL-0127) Avail: NTIS HC A05/MF A01 CSCL 14/2

The High Resolution Optical Power Spectrum Analyzer (HOPS) was conceived as a better approach to a large volume optical power spectrum (OPS) scanning of imagery. This approach enables conventional OPS measurement coupled with simplified parallel optical film sampling, rather than film scanning. The HOPS is a coherent optical system that lends itself to many applications either proposed or demonstrated, such as pattern recognition, feature extraction and image assessment. Custom configuration of HOPS enables optimum use of off-the-shelf scanning photodiode arrays and adaption to specific film scanning and spectrum sampling requirements. This work demonstrates the basic metric equivalence between HOPS and conventional OPS. It also demonstrates the advantages of the HOPS configuration for OPS measurement. Several configurations of HOPS have been evaluated. A design using linear, self-scanned photodiode arrays with parallel optical trains is recommended. This report presents detailed analysis and measurements supporting HOPS as a highly practical approach to OPS scanning. Author (GRA)

N78-23906# McDonnell Aircraft Co., St. Louis, Mo.
NON-LINEAR LENS MODIFICATION Final Technical Report
George Licis 29 Feb. 1978 4 p
(Contract N60921-77-M-E169)
(AD-A051799; MC7-313-3452) Avail: NTIS HC A02/MF A01 CSCL 20/6

The problem with conventional optical systems is that they suffer from a lack of adequate resolution because of the wide field of view necessary for initial target acquisition. The wide field of view is required because the target may be off-axis. After initial acquisition, a narrow field of view high resolution optical system is required. The non-linear lens combines both of these features, wide field of view and high resolution on-axis. A zoom capability was added to the basic non-linear lens to evaluate the effect of a range of wide fields of view. GRA

N78-23907# Laser Diode Labs., Inc., Metuchen, N. J.
INJECTION LASER DIODES FOR FIBER OPTIC COMMUNICATIONS Quarterly Report, 1 Jan. - 31 Mar. 1977
Rob Adair 22 Jul. 1977 38 p refs
(Contract DAAB07-76-C-0040)
(AD-A051792; QR-3) Avail: NTIS HC A03/MF A01 CSCL 09/1

The design and fabrication of injection laser diodes for use in fiber optic communications is discussed with regard to material synthesis, chip configuration, and device assembly in manufacturing environment. The opto-electronic source is based on the GaAs-GaA1As double heterojunction structure and consists of a parallel array of lasers formed by the applications of triple stripe geometry to the surface of the epitaxial wafer. The monolithic triad of discrete lasing elements is mounted in a high frequency package which incorporates a high quality optical window. Author (GRA)

N78-23908# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
TEAL RUBY EXPERIMENT. PHASE 1: DEFINITION STUDY. VOLUME 1, PART 2: APPENDIXES Final Technical Report
E. H. Smith May 1977 253 p
(Contract F04701-77-C-0024; ARPA Order 3058)
(AD-A051469; LMSC-L029787-Vol-1-Pt-2-App; SAMSO-TR-78-55-Vol-1-Pt-2-App) Avail: NTIS HC A12/MF A01 CSCL 17/5

Contents: Program Management Plan; Reliability/Maintainability Plan; Quality Assurance Plan; System Safety Plan; Contamination Assessment and Control Plan; Corrosion Prevention and Control Plan; and Preliminary Finish Specification. GRA

N78-23909# Air Force Geophysics Lab., Hanscom AFB, Mass.
STUDY OF THE DUAL-INPUT MODE WITH THE AFGL TWO-METER PATH DIFFERENCE INTERFEROMETER
George A. Vanasse and Hajime Sakai 4 Oct. 1977 16 p
(AD-A051124; AFGL-TR-77-0213; AFGL-IP-259) Avail: NTIS HC A02/MF A01 CSCL 20/6

Experimental testing of the dual-input dual-output operation of the AFGL two-meter path difference interferometer is described, together with the results. It has been found that the external modulation scheme for the interferometer is poorly suited for good suppression. The reasons supporting this conclusion are presented. Author (GRA)

N78-23910# Stanford Univ., Calif. Edward L. Ginzton Lab.
ACOUSTICALLY SCANNED OPTICAL IMAGING DEVICES Semiannual Report, 1 Jul. - 31 Dec. 1977
Gordon S. Kino Feb. 1978 125 p refs
(Contract N00014-76-C-0129; ARPA Order 2778)
(AD-A051559; SU-GL-2784; SAR-5) Avail: NTIS HC A06/MF A01 CSCL 20/6

The first successful ZnO on Si storage correlator has been made. Signals with a time-bandwidth product of 30,000 have been correlated. A GaAs convolver has been constructed with good results, and a GaAs correlator is in process. Complete theory of the storage correlator has been developed and checks well with experiments. GRA

N78-23911# Ballistic Research Labs., Aberdeen Proving Ground, Md.
AN INFRARED DATA ACQUISITION AND PROCESSING SYSTEM Final Report
Morgan T. Reedy and Earl P. Weaver Sep. 1977 34 p
(DA Proj. 1T6-62611-AH-81)
(AD-A051182; AD-E400059; BRL-MR-2790) Avail: NTIS HC A03/MF A01 CSCL 17/5

This report presents a description of an Infrared Data Acquisition and Processing System (IRDAPS). The description includes a discussion of the IRDAPS System hardware, system operating software, project oriented special software and its application to high energy laser beam diagnostic measurements. The report also points out that since the IRDAPS contains a flexible FORTRAN language based computing system, it is well suited to the general data acquisition and analysis area. Author (GRA)

N78-23912# European Space Agency, Paris (France).
COMPARISON OF THERMO-OPTICAL MEASUREMENTS MADE BY SIX EUROPEAN LABORATORIES. PROJECT FOR STANDARDIZATION OF MEASUREMENT METHODS AND EQUIPMENT
F. Levadou Mar. 1978 18 p Transl. into ENGLISH from ESA Journal (Paris), v. 1, no. 2, 1977 p 209-221 Original report in FRENCH previously announced as A77-48657
(ESA-TT-444) Avail: NTIS HC A02/MF A01

Measurements of solar absorption and the total hemispherical emission obtained by six laboratories were compared. Each laboratory used three thermal control coatings in conjunction with its equipment; the coatings were white silicone paint - ZnO pigment, black epoxy paint, and aluminized adhesive tape. The range of measurements is described, and a statistical analysis was performed for each coating. The relationship between laboratory calculation methods and discrepancies in the measure-

ments is considered, and the desirability of standardizing methods is suggested. Author (ESA)

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N78-23913 Wisconsin Univ., Madison.
LOW FREQUENCY RF HEATING OF PLASMAS IN A TOROIDAL STELLARATOR Ph.D. Thesis
Stephen Noah Golovato 1977 299 p
Avail: Univ. Microfilms Order No. 77-28249

Transit-time magnetic pumping and Alfven wave heating experiments, were conducted in the Proto-Celo stellarator to investigate both plasma heating and plasma confinement. A traveling wave was launched around the stellarator to attempt transit-time magnetic pumping of a pulsed electron beam moving along the magnetic field lines. An apparent loss of the beam was seen when the transit-time magnetic pumping was applied. Alfven wave heating was applied to plasmas in the stellarator. Global excitation of Alfven waves was accomplished by exciting an electrostatistically shielded helical winding corresponding to a q=3 rational field line with a pulsed, high power RF source. Theoretical analysis of this helical wave launcher predicted effective energy absorption in the Proto-Cleo gun produced plasma. Dissert. Abstr.

N78-23914 Wisconsin Univ., Madison.
EXPERIMENTAL INVESTIGATION OF PLASMA RESISTIVITY AND OHMIC HEATING IN THE OCTUPOLE WITH TOROIDAL MAGNETIC FIELD Ph.D. Thesis
Joan Frances Etzweiler 1977 169 p
Avail: Univ. Microfilms Order No. 7800013

Plasma resistivity parallel to the magnetic field in a small octupole with toroidal magnetic field was investigated using the flux surface constant (current density divided by magnetic field magnitude) to measure the average resistivity on a flux surface. An heuristic model for resistivity based on the neoclassical effects of Coulomb collisions and particle trapping in the magnetic mirrors was modified to include neutral collisions and the reduction, caused by the parallel electric field, of mirror trapping. The effects of the magnetic mirrors on the resistivity were assessed and found to be significant. The local ohmic heating rate and plasma current density and their integrals were also calculated. Dissert. Abstr.

N78-23915 Pittsburgh Univ., Pa.
THERMAL CONDUCTIVITY OF DENSE NEON PLASMAS Ph.D. Thesis
Pauline PuHsu Lee 1977 95 p
Avail: Univ. Microfilms Order No. 7801870

Numerical calculations are presented for electron thermal conduction in neon plasmas at superhigh densities (20 g/cc up to 4000 g/cc) and temperature, where the electron gas is degenerate but the material is not completely ionized. Features of this calculation were used of a Thomas-Fermi potential to obtain the ion pair correlation via fluid perturbation theory and calculation of electron-ion scattering by numerical solution of the Schroedinger equation. The thermal conductivity was obtained by adaptation of the Ziman theory for electron transport properties of liquid metals. Dissert. Abstr.

N78-23916 Michigan Univ., Ann Arbor.
NEUTRAL ATOM TRANSPORT IN TOKAMAK PLASMAS BY MULTIGROUP DISCRETE ORDINATES METHODS Ph.D. Thesis
John Gerard Gilligan 1977 187 p
Avail: Univ. Microfilms Order No. 78-04708

Multigroup discrete ordinates (MGDO) methods, originally developed to determine neutron transport solutions, were applied to low energy neutral atom transport in Tokamak plasmas. This was possible because neutral behavior in a plasma was governed by the same linear Boltzmann equation that describes neutrons in matter. The approach was advantageous because MGDO methods avoid many of the approximations that were used in previous neutral analyses. The usefulness of the MGDO method in performing neutral benchmark calculations was self evident. A brief overview of low energy neutral atom sources and effects in Tokamak plasmas served as a starting point for the analysis. A detailed investigation of neutral particle interactions then led to the formulation of a neutron-neutral reaction analogy. Dissert. Abstr.

N78-23917 Maryland Univ., College Park.
ANALYTIC AND NUMERICAL STUDIES OF MICROINSTABILITIES DRIVEN BY IONS Ph.D. Thesis
Joan Mary Ogden 1977 193 p
Avail: Univ. Microfilms Order No. 78-05030

The linear and nonlinear stages of an electromagnetic ion cyclotron or ion whistler instability, which is driven by ion energy anisotropy in a magnetized plasma were examined. The linear and quasilinear theory of the instability are presented, and computer simulations are carried out using an electromagnetic particle code. The quasilinear model and the simulations are in good agreement, and both indicate that the instability saturates by reducing the ion anisotropy to a sufficiently small value, and rather than by magnetic trapping. The microstability properties of field-reversing ion layers and of theta-pinch with reflected ions are also discussed. Dissert. Abstr.

N78-23918 Florida Univ., Gainesville.
TWO-AND THREE-BODY CORRELATIONS IN SIMPLE GASES Ph.D. Thesis
Lynn James Groome 1977 351 p
Avail: Univ. Microfilms Order No. 7806702

The static and dynamic behavior of xenon was studied both experimentally (via inelastic neutron scattering) and theoretically. Measurement of the static structure factor, S(Q), at low densities is discussed as a means for providing details concerning three body forces. A similar study of the dynamic structure factor is proposed as a test of linear kinetic theory. The analysis of the time-of-flight data is performed using the N = 6 Gross-Jackson kinetic model for a hard core fluid. A comparison of this model (assuming hard spheres, and hard cores having attractive forces) with experiment indicates clearly that hard spheres are not an adequate model for xenon at the state conditions studied. The agreement between experiment and the theory for attractive spheres is quite good. Dissert. Abstr.

N78-23919 California Univ., Irvine.
ION BEAM-PLASMA INTERACTIONS IN Q-MACHINE PLASMAS Ph.D. Thesis
James Pierre Hauck 1976 400 p
Avail: Univ. Microfilms Order No. 78-05043

The interaction of an energetic ion beam with collisionless magnetized Q-machine plasma is examined. Results of experiments in which ion beams were injected parallel to the magnetic field (axially) as well as perpendicular to the magnetic field (transversely) are presented. The electrostatic dispersion relation for a mono-energetic ion beam directed obliquely to the magnetic field in an anisotropic Maxwellian plasma is derived. Solutions of the dispersion relation are compared with experimental results for a wide variety of beam-plasma interactions. Wave damping mechanisms and instability conditions are considered. A variety of possible transverse ion beam injection schemes are discussed including injection into plasma with radial electric and axial magnetic fields. Interactions of a transversely injected ion beam with surface waves on the plasma column are described. It is shown that shear Kelvin-Helmholtz waves can strongly modify an energetic ion beam both deflecting the beam and reducing its energy. Dissert. Abstr.

N78-23920 Michigan Univ., Ann Arbor.
CRITICAL LAYER PENETRATION IN A COLD Z-PINCH PLASMA BY HIGH-INTENSITY 10.6 MICRON LASER RADIATION Ph.D. Thesis
John Goodyear Ackenhusen 1977 356 p
Avail: Univ. Microfilms Order No. 7804631

The intensity dependence of transmission of 0.2-4 hundred billion W/sq cm laser radiation through an overdense cold Z-pinch plasma was measured to determine a threshold for transmission. The 10.6 micron 0.2-4 hundred CO2 laser radiation was focused

to a diffraction-limited spot of 125 micron diameter, radially incident on the plasma column of 1 mm critical radius. Holographic interferometry at 347.2 nm, perpendicular to both the column axis and laser axis, provided radial density profiles and density information about the laser-induced shock. An intensity threshold for transmission was measured to be about 3.5 hundred billion W/sq cm for incidence on the pre-pinch plasma, and 2 hundred billion W/sq cm for the post-pinch plasma. Dissert. Abstr.

N78-23921 California Univ., San Diego.
EQUILIBRIUM, WAVES AND TRANSPORT IN THE PURE ELECTRON PLASMA Ph.D. Thesis
John Sidney DeGrassie 1977 191 p
Avail: Univ. Microfilms Order No. 7805742

The properties of the equilibrium, low frequency waves and transport of a newly realized laboratory plasma, the pure electron plasma are investigated. In order to create this plasma column a new concept in thermionic cathodes was developed. The dispersive properties of plasma waves in the pure electron plasma are measured. Transport due to both classical and collective processes is investigated. Collective transport is studied by externally launching modes of the plasma and observing the wave induced transport. Detailed results on the experimental properties of these modes since this is the first experimental investigation of launched diocotron waves are presented. Also described are regimes in which anomalous transport occurs due to the presence of naturally occurring collective modes.
Dissert. Abstr.

N78-23922 California Univ., Los Angeles.
COMPUTER SIMULATION STUDY OF WAVES IN BOUNDED PLASMA WITH APPLICATION TO LOWER HYBRID HEATING Ph.D. Thesis
Viktor Konstantyn Decyk 1977 253 p
Avail: Univ. Microfilms Order No. 7806469

A computer model is developed for simulating a bounded plasma slab. The computer model is tested by examining the propagation of linear waves in a plasma slab bounded by vacuum. A differential wave equation for bounded plasma is derived. The model is extended by adding an external magnetic induction field and the propagation of linear waves in a bounded, magnetized plasma is studied. The differential wave equation is extended to include an external magnetic field, and the dispersion relation is obtained. The model is applied to the problem of excitation by external sources of lower hybrid waves in a finite but homogeneous plasma slab. The plasma response is studied in detail and important kinetic and nonlinear effects are identified. Dissert. Abstr.

N78-23923*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PARAMETRIC DEPENDENCE OF ION TEMPERATURE AND RELATIVE DENSITY IN THE NASA LEWIS SUMMA FACILITY
A. Snyder, M. R. Lauver, and R. W. Patch 1976 36 p refs
Presented at 18th Ann. Meeting on Plasma Phys., San Francisco, 14-18 Nov. 1976; sponsored by Am. Phys. Soc.
(NASA-TM-73770; E-9563) Avail: NTIS HC A03/MF A01 CSCL 20I

Further hot-ion plasma experiments were conducted in the SUMMA superconducting magnetic mirror facility. A steady-state ExB plasma was formed by applying a strong radially inward dc electric field between cylindrical anodes and hollow cathodes located near the magnetic mirror maxima. Extending the use of water cooling to the hollow cathodes, in addition to the anodes, resulted in higher maximum power input to the plasma. Steady-state hydrogen plasmas with ion kinetic temperatures as high as 830 eV were produced. Functional relations were obtained empirically among the plasma current, voltage, magnetic flux density, ion temperature, and relative ion density. The functional relations were deduced by use of a multiple correlation analysis. Data were obtained for midplane magnetic fields from 0.5 to 3.37 tesla and input power up to 45 kW. Also, initial absolute electron density measurements are reported from a 90 deg Thomson scattering laser system. Author

N78-23924*# SRI International Corp., Menlo Park, Calif.
EVALUATION OF VOLCANO-STYLE FIELD IONIZATION SOURCE AND FIELD EMITTING CATHODES FOR MASS SPECTROMETRY AND APPLICATIONS Final Report
S. E. Buttrill, Jr. and C. A. Spindt 1 Mar. 1978 23 p refs
(Contracts NAS7-100; JPL-954840; SRI Proj. PYD-6932)
(NASA-CR-156986) Avail: NTIS HC A02/MF A01 CSCL 20I

A volcano-style field ionization source was tested with eight different gases: hydrogen, helium, ammonia, methane, argon, neon, water vapor, and hydrogen sulfide. For ammonia, hydrogen sulfide, and water, the ionization efficiency of the field ionization source was determined as a function of the electrical potential difference between the ionizer and its counterelectrode. The ionization efficiencies for the other gases were too low to be measured in the present apparatus. The operating characteristics of a field emission cathode, were studied, in the presence of the same eight gases at pressures up to 0.00001 torr. The presence of the gases caused little or no significant change in the electron emission from the cathodes. Results indicate that the field emission cathode has advantages over electrically heated cathodes as a source of an electron beam in spacecraft mass spectrometers.
Author

N78-23925# Naval Research Lab., Washington, D. C.
ABSORPTION AND TRANSFORMATION OF ELECTROMAGNETIC WAVES IN THE VICINITY OF ELECTRON CYCLOTRON HARMONICS Interim Report
Thomas M. Antonsen, Jr. and Wallace M. Manheimer Nov. 1977 35 p refs
(Contract E(49-20)-1006)
(AD-A051938; AD-E000126; NRL-MR-3583) Avail: NTIS HC A03/MF A01 CSCL 20/9

The recent development of multikilowatt millimeter wave sources has motivated the study of electron cyclotron heating of Tokamaks. The direct absorption of the ordinary and extraordinary modes at the first and second harmonics of the electron cyclotron frequency are examined. For K x B = O WKB theory is inapplicable and a full wave treatment is necessary to determine transmission, absorption, reflection and mode conversion coefficients. The ordinary wave is efficiently absorbed at the first harmonic. The extraordinary wave is efficiently absorbed at the second harmonic due to mode conversion of the incident wave to a highly damped electrostatic wave. Author (GRA)

N78-23926# Technion - Israel Inst. of Tech., Haifa.
PROPERTIES OF ELECTRON GAS IN CONSTANT MAGNETIC AND ELECTRIC FIELDS Final Technical Report, Oct. 1976 - Oct. 1977
J. Zak Oct. 1977 29 p refs
(Grant DA-ERO-76-G-45)
(AD-A051823) Avail: NTIS HC A03/MF A01 CSCL 20/9

A method is developed for defining localized states and effective Hamiltonians in perturbed crystals. The method is based on the localization ideas in the kq representation for perfect lattices. An equation is derived defining localized states for perturbations caused by an impurity, the magnetic and electric fields. First, the impurity problem is considered in detail. A correction term is obtained to the one-band Koster-Slater effective Hamiltonian. It is shown to be significant for bound states and scattering cross sections of a localized impurity. Second, an orthonormal set of localized states for a crystal with a perturbation is developed. It includes the impurity problem, surface states, superlattices and other perturbations. These localized states are used for deriving one-band effective Hamiltonians up to second order of the perturbation expansion. Relatively simple results for localized states and one-band Hamiltonians are obtained in the cases of wide and narrow energy gap crystals. The orthonormal set of states that diagonalize the Hamiltonian is also used for deriving an expression for local charge densities in a perturbed crystal which can directly be compared with experiment. GRA

N78-23927# Florida Univ., Gainesville. Dept. of Engineering Sciences.
TWO-PHASE HARTMANN FLOWS IN THE MHD GENERATOR CONFIGURATION Annual Report, Dec. 1976 - Dec. 1977
Rush E. Elkins, III, U. H. Kurzweg, Thomas A. Trovillion, and E. Rune Lindgren Feb. 1978 59 p refs
(Contract N00014-76-C-0410)
(AD-A051450) Avail: NTIS HC A04/MF A01 CSCL 10/2

Since the mass density and viscosity of the liquid in a

two-phase Faraday generator are much greater than those of the gas, consideration of the liquid phase alone should lead to a good description of force distribution in the generator. Averaging the motion over the liquid phase gives us a set of equations which is similar to equations describing a steady flow of a fluid with spatially variable properties. Solutions of these equations are discussed first in the limit of negligible inertia and viscosity, and then in the limit of negligible inertia and non-zero viscosity. The cross stream pinch pressure gradient and its possible effects on the two-phase flow are discussed. The wall region in Faraday generators is a region of very large shear and is important in determining efficient generator operation, as is demonstrated in finite difference calculations carried out under a variety of conditions and also in an analytical boundary layer approximation which has been developed. A section has also been devoted to the possibilities of improved generator efficiency by subpartitioning the generator duct. The last section concerns similitude between two-phase generators and two-phase gravity flows. There are two velocity scales in the systems which must be scaled separately. GRA

N78-23928# Los Alamos Scientific Lab., N. Mex.
PARAMETRIC STUDY OF PLASMA STARTUP SYSTEMS FOR TOKAMAKS
H. F. Vogel 1977 4 p refs Presented at the 7th Symp. on Eng. Probl. of Fusion Res., Knoxville, Tenn., 25-28 Oct. 1977
(Contract W-7405-eng-36)
(LA-UR-77-2472; Conf-771029-26) Avail: NTIS HC A02/MF A01

Plasma initiation from a poloidal coil set is discussed for inducing the startup voltage where no magnetic flux is generated in the plasma region. A mathematical expression is reported which states the current distribution necessary in a toroidal shell for the zero field condition inside. The combination of the startup coil in one physical unit with the vertical field coil is considered. A flux plot is discussed for the case that the coil set is mounted outside the toroidal field coils and iron used for reducing the magnetic field energy. ERA

N78-23929# Argonne National Lab., Ill.
POWER AND GAS FLOW MODELS FOR MONOENERGETIC NEUTRAL BEAM INJECTORS
J. A. Fasolo 1977 9 p refs Presented at 7th Symp. on Fusion Research Project, Knoxville, Tenn., 25 Oct. 1977
(Contract W-31-109-eng-38)
(CONF-771029-188) Avail: NTIS HC A02/MF A01

Large, ignition Tokamak reactors, (ITR, EPR, and beyond) will require supplemental heating to achieve ignition. In the earlier machines, at least, this heating will probably be provided by monoenergetic neutral beams. These beams, with energies approximately greater than 150 keV, will most likely be derived from D(+) or D(-) ions produced by direct extraction ion sources. Models were developed for power and gas flow in injectors which employ direct extraction D(+) or D(-) ion sources. The power flow model accounts explicitly for all beam losses in terms of line densities of gas along paths traversed by ions and neutrals and cross sections for dissociation and charge-changing collisions. The gas flow model uses the results of power flow calculations and known gas flows from sources and neutralizers to determine gas loads and pumping requirements in various parts of the injector. ERA

N78-23930# Illinois Univ., Urbana. Gaseous Electronics Lab.
FOCUSSING OF AN ION BEAM FROM A REFLEX TRIODE
R. J. Kaye, G. B. Johnson, and J. T. Verdeyen Nov. 1977 15 p
(Contract EY-76-S-02-2765)
(COO-2765-7) Avail: NTIS HC A02/MF A01

An electron beam in a reflex triode was used to extract an ion beam from a background plasma. Electrostatic space charge fields accelerate, focus, and tailor the arrival times of the ions on a target, preferably in spherical geometry. Advantages of the method include: power multiplication due to tailoring of the ion arrival times, better focussing properties of ions, and the target is physically remote from the beam source. ERA

N78-23931# California Univ., Livermore. Lawrence Livermore Lab.
ENGINEERING PROBLEMS OF THE FUTURE NEUTRAL BEAM INJECTORS
J. Fink 1977 20 p Presented at Plasma Heating Development Requirements Workshop, Gaithersburg, Md.
(Contract W-7405-eng-48)
(UCRL-80384; Conf-771213-1) Avail: NTIS HC A02/MF A01

There is no limit to the energy or power that can be delivered by a neutral-beam injector, its use will be restricted by either its cost, size, or reliability. These factors can be improved by the injector design. Several examples, taken from mirror reactor studies, are given. ERA

N78-23932# California Univ., Livermore. Lawrence Livermore Lab.
HIGH ENERGY ELECTRON SPECTRA FROM 1.06 MUON m LASER PRODUCED PLASMAS
K. G. Tirsell and H. C. Catron 1977 8 p refs Presented at Ann. Amer. Phys. Soc. Meeting, Atlanta, 7 Nov. 1977
(Contract W-7405-eng-48)
(UCRL-80322-Summ; Conf-771136-15) Avail: NTIS HC A02/MF A01

An electron spectrometer was modified to measure 1.06 micron laser produced electrons in the 0.2 to 1.0 MeV range. A strong correlation between laser pulse width and the amplitude of electron spectral emission from imploded D-T filled microspheres was observed. ERA

N78-23933# Oak Ridge National Lab., Tenn.
REMOTE SERVICING CONSIDERATIONS FOR NEAR TERM TOKAMAK POWER REACTORS (TNS) Final Summary
P. T. Spampinato 1977 26 p refs Presented at ANS Winter Meeting, San Francisco, 27 Nov. 1977
(Contract W-7405-eng-26)
(CONF-771109-84) Avail: NTIS HC A03/MF A01

Next generation Tokamaks require special consideration for remote servicing. Three major problems are highlighted: (1) movement of heavy components; (2) remote connection/disconnection of joints; and (3) remote cutting, welding, and leak detection. The first problem is assumed to be handled with existing expertise and is not considered. The remaining problems are thought to be minimized by considering two engineering departures from conventional Tokamak design; locating the field shaping coils outside the toroidal coils and enclosing the total device within an evacuated reactor cell. Five topics under this vacuum building concept are discussed: incremental cost, vacuum pumping, tritium containment, activation topology, and first year operations. ERA

N78-23934# Oak Ridge National Lab., Tenn. Fusion Energy Div.
FUSION-FISSION ANALOGY
J. Rand McNally, Jr. 1977 6 p refs Presented at ANS Winter Meeting, San Francisco, 27 Nov. 1977
(Contract W-7405-eng-26)
(CONF-771109-85) Avail: NTIS HC A02/MF A01

The analogy of plasma ignition of fusion devices to criticality in fission systems is shown. The four-factor formula is presented and special emphasis is given to the energy utilization factor, which now dominates fusion research. Instead of keeping books on neutrons, as in the fission case, the fusion case follows the plasma energy density. ERA

N78-23935# Oak Ridge National Lab., Tenn.
STATUS OF THE USA PROGRAM ON THE DEVELOPMENT OF SUBMILLIMETER LASERS TO MEASURE ION TEMPERATURES
C. F. Barnett, D. P. Hutchinson, K. VanderSluis, and P. A. Staats 1977 10 p Presented at 2d Conf. on Hot Plasma Diagnostics, Kharkov, 22 Sep. 1977
(Contract W-7405-eng-26)
(CONF-770954-5) Avail: NTIS HC A02/MF A01

The concept of ion laser scattering is outlined briefly, and the parameters of the required submillimeter laser system are described. The current state of the development of lasers, laser and viewing dumps, and detectors is reviewed. ERA

N78-23936# Princeton Univ., N. J. Plasma Physics Lab.
THEORY AND NUMERICAL SIMULATIONS ON COLLISIONLESS DRIFT INSTABILITIES
C. Z. Cheng and H. Okuda Nov. 1977 69 p refs
(Contract EY-76-C-02-3070)
(PPPL-1397) Avail: NTIS HC A04/MF A01

Nonlinear behavior of the collisionless drift instabilities and the resultant anomalous plasma diffusion have been studied by means of computer simulations and analytic theory. The simulation model used is a full three dimensional electrostatic model in a cylindrical geometry in an external magnetic field. Full dynamics is employed for the ion motion while the guiding center approximations are used for the motion of electrons which allows us to use rather realistic plasma parameters in the simulations. The results of simulations indicate that a strong turbulence develops through the nonlinear interaction of the drift instabilities which results in the formation of convective cells and anomalous particle diffusion. The broad frequency spectrum resembles those observed recently in toroidal confinement devices. Analytic theory is developed based on the mode-coupling process to explain the generation of convective cells and strong plasma turbulence along with the estimate of the resultant particle diffusion. ERA

N78-23937# Texas Univ., Austin.
TEXT ENERGY STORAGE SYSTEM
W. F. Weldon, H. G. Rylander, and H. H. Woodson 1977 14 p refs
(Contract ES-77-5-05-5594)
(ORO-5594-9) Avail: NTIS HC A02/MF A01

The Texas experimental Tokamak (TEXT) energy storage system, consists of four 50 MJ, 125 V homopolar generators and their auxiliaries and is designed to power the toroidal and poloidal field coils of TEXT on a two-minute duty cycle. The four 50 MJ generators connected in series were chosen because they represent the minimum cost configuration and also represent a minimal scale up from the successful 5.0 MJ homopolar generator designed, built, and operated by the Center for Electromechanics. ERA

N78-23938# California Univ., Livermore. Lawrence Livermore Lab.
LIQUID METAL REQUIREMENTS FOR INERTIAL CONFINEMENT FUSION
Wayne R. Meier and James A. Maniscalco 1977 35 p refs Presented at NACE Meeting on Corrosion, Houston, Tex., 6-10 Mar. 1978 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-80424; Conf-780308) Avail: NTIS HC A03/MF A01

The lithium waterfall reactor is described as a concept in which liquid lithium serves as the coolant, tritium breeder, and 1st wall and blanket structure protector. This reactor has emerged as a promising concept that alleviated the major problems associated with inertial confinement fusion systems. It eliminated the first wall problems resulting from X-rays and pellet debris, and minimized cyclical thermal stresses. Also, the thick falling region of lithium attenuated neutrons to the point where the blanket structure could survive for the lifetime of the power plant at high power densities. ERA

N78-23939# Argonne National Lab., Ill.
PLASMA ENGINEERING STUDIES FOR THE TOKAMAK EXPERIMENTAL POWER REACTOR
W. M. Stacey, Jr., J. N. Brooks, K. Evans, Jr., and A. M. M. Todd (Princeton Univ.) 1977 7 p refs Presented at 7th Symp. on Fusion Res. Proj., Knoxville, Tenn., 25-28 Oct. 1977
(Contract W-31-109-eng-38)
(CONF-771029-190) Avail: NTIS HC A02/MF A01

Design of a Tokamak experimental power reactor (EPR) was studied. Magnetohydrodynamic (MHD) equilibrium and stability calculations, which establish the ranges of beta/sub t/ and the corresponding MHD parameters are described along with particle and power balance calculations, which are used for sizing and tradeoff studies, and burn cycle dynamics calculations, which determine start-up and driving systems requirements and reactor net power output. The resulting EPR reference design is discussed. ERA

N78-23940# Argonne National Lab., Ill.
THERMAL RESPONSES OF TOKAMAK REACTOR FIRST WALLS DURING CYCLIC PLASMA BURNS
D. L. Smith and I. Charak 1977 8 p refs Presented at 7th Symp. on Fusion Res. Proj., Knoxville, Tenn., 25-28 Oct. 1977
(Contract W-31-109-eng-38)
(CONF-771029-189) Avail: NTIS HC A02/MF A01

The CINDA-3G computer code was adapted to analyze the thermal responses and operating limitations of two fusion reactor first-wall concepts under normal cyclic operation. A component of an LMFBR computer was modified and adapted to analyze the ablative behavior of first-walls after a plasma disruption. The first wall design concepts considered are a forced-circulation water-cooled stainless steel panel with and without a monolithic graphite determined for several burn-cycle scenarios and the extent of surface ablation that results from a plasma disruption was determined for stainless steel and graphite first surfaces. ERA

N78-23941# Chalmers Univ. of Technology, Goteborg (Sweden). Inst. for Electromagnetic Field Theory and Plasma Physics.
THE GROWTH OF MODULATIONAL INSTABILITY FOR RANDOMIZED INITIAL CONDITIONS Research and Training Programme on Controlled Thermonuclear Fusion and Plasma Physics (EUR-NE)
J. Weiland 1977 26 p refs
(CTH-IEFT/PP-1977-2) Avail: NTIS HC A03/MF A01

Modulational plasma instability was studied for a self consistent situation in which there is no pumping. The phases of different k models were chosen in a random way. The solutions presented indicate a strong tendency for creation of several solutions when the initial phases of the Fourier components in space of E are picked in a random way. The limit of close packaging is not reacted. ESA

N78-23942# Chalmers Univ. of Technology, Goteborg (Sweden). School of Electrical Engineering.
SOME CONTRIBUTIONS TO THE STUDY OF NONLINEAR DISPERSIVE WAVE PHENOMENA IN PLASMAS Ph.D. Thesis
Roland Nakach May 1977 87 p refs
(CTH-TR-72) Avail: NTIS HC A05/MF A01

For a number of nonlinear evolution equations of physical significance it is shown that certain nonstationary similarity solutions exist and they can be expressed in terms of various Painleve transcendents if and only if the associated eigenvalue (scattering) operator is of second differential order. This result may be used as a test for the nature of the appropriate eigenvalue operator associated with a given nonlinear evolution equation. The problem of accounting for dissipative processes in the nonlinear interaction of dispersive waves is studied. A result of the investigation enables us to conclude that the solution to the problem of the evolution in time of three coherently interacting waves for which the linear dissipations are different corresponds to a class of transcendental functions for which the singularities of the general solution are of more complicated nature than those of the third Painleve transcendent. Author (ESA)

N78-23943# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
PLASMA FLOW IN A CURVED MAGNETIC FIELD
Lennart Lindberg Aug. 1977 35 p refs Submitted for publication Sponsored by Swed. Atomic Res. Council
(TRITA-EPP-77-23) Avail: NTIS HC A03/MF A01

A beam of collisionless plasma was injected along a longitudinal magnetic field into a region of curved magnetic field. Two unpredicted phenomena were observed: the beam becomes deflected in the direction opposite to that in which the field is curved, and it contracts to a flat slab in the plane of curvature of the magnetic field. The plasma was produced by a conical theta-pinch gun. It was studied by means of high speed photography, electric and magnetic probes, ion analyzer, and spectroscopy. The plasma beam is collisionless and its behavior is in principle understood on the basis of gyro-center drift theory. The phenomenon is of a general character and can be expected to occur in a very wide range of densities. The lower density limit is set by the condition for self-polarization. The upper limit is presumably set by the requirement omega sub e tau sub e greater than 1. The phenomenon is likely to be of importance

e.g. for injection of plasma into magnetic bottles and in space and solar physics. Author (ESA)

N78-23944# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
ELECTRON TEMPERATURE MEASUREMENTS IN LOW DENSITY PLASMAS BY HELIUM SPECTROSCOPY
N. Brenning Sep. 1977 25 p refs Sponsored by Swed. Atomic Res. Council
(TRITA-EPP-77-24) Avail: NTIS HC A02/MF A01

The method using relative intensities of singlet and triplet lines of neutral helium to measure electron temperature in low-density plasmas is examined. Calculations from measured and theoretical data about transitions in neutral helium are carried out and compared with experimental results. It is found that relative intensities of singlet and triplet lines from neutral helium can be used for the electron temperature determination only in low-density, short-duration plasmas. The most important limiting processes are excitation from the metastable 23S level and excitation transfer in collisions between electrons and excited helium atoms. An evaluation method is suggested, which minimizes the effect of these processes. Author (ESA)

N78-23945# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
MAIN FEATURES AND POTENTIALITIES OF GAS-BLANKET SYSTEMS Research and Training Programme on Controlled Thermonuclear Fusion and Plasma Physics (EUR-NE)
B. Lehnert Sep. 1977 70 p refs Sponsored by European Communities
(TRITA-PFU-77-03) Avail: NTIS HC A04/MF A01

A review is given of the features and potentialities of coldblanket systems, with respect to plasma equilibrium, stability, and reactor technology. The treatment is concentrated on quasi-steady magnetized plasmas confined at moderately high beta values. In these systems an impermeable plasma becomes separated from surrounding walls by a dense and cold partially ionized region. Steady solutions exist within limited parameter ranges. The pressure and density profiles are affected by ionization of neutral gas, by the presence of various atom species and impurities, as well as by Nernst, toroidal, and anomalous effects. Further, the partially ionized boundary layer becomes diamagnetic, the neutral gas pressure does not balance the plasma pressure, the heat balance determines the boundary layer thickness, and the strongly inhomogeneous distributions of the plasma and the neutral gas parameters in space have important effects on stability, especially on account of an existing boundary layer. The cold blanket concept has specific potentialities as a fusion reactor, e.g. in connection with the desired densities and dimensions of full-scale systems, refuelling, as well as ash and impurity removal, and stability. Author (ESA)

N78-23946# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
ELECTRON TEMPERATURE MEASUREMENTS IN A DENSE PLASMA USING A SELF-SWEPT DOUBLE PROBE Research and Training Programme on Controlled Thermonuclear Fusion and Plasma Physics (EUR-NE)
J. R. Drake Sep. 1977 8 p refs Sponsored in part by European Communities and US NSF
(TRITA-PFU-77-05) Avail: NTIS HC A02/MF A01

A complete floating double probe current-voltage characteristic and an estimate of the electron temperature can be generated in one shot in dense plasmas by discharging a capacitor through the plasma and monitoring the probe current and bias voltage. Author (ESA)

N78-23947# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
ON THE IONIZATION AND BURNOUT PROCESSES OF A MAGNETICALLY CONFINED PLASMA Research and Training Programme on Controlled Thermonuclear Fusion and Plasma Physics (EUR-NE)
B. Lehnert Oct. 1977 24 p refs Sponsored by European Communities
(TRITA-PFU-77-06) Avail: NTIS HC A02/MF A01

The particle and heat balance during plasma start-up are investigated, to specify the conditions for reaching various ion density ranges and high plasma temperatures in cases of a limited heating power. Particular attention is paid to the permeable-impermeable transition regime of plasmas being subject to Ohmic heating and confined in closed or open bottles with a main poloidal field. The ionization and burnout conditions are found to depend critically on the confinement and the filling density. They become optimal in closed bottles under symmetric and stable conditions, where the transition into a fully ionized state should be reached even at moderately large ionization rates, burnout powers, and currents. Start-up methods based on constant as well as on variable filling densities are discussed as means of ion density control. Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N78-23948 Rutgers - The State Univ., New Brunswick, N. J.
AXIAL CHANNELING IN THIN CRYSTALS: A QUANTITATIVE INVESTIGATION OF TRANSMISSION SPECTRA Ph.D. Thesis
Joel Steven Rosner 1977 145 p
Avail: Univ. Microfilms Order No. 7805123

A quantitative investigation of the transmission spectra of protons channeled through thin silicon single crystals was made possible by the recent development of two-dimensional position-sensitive detectors. The spectra fall into two classes corresponding to very low and intermediate to high transverse energy. The spectra are composed of groups of particles which have bounced off the potential wall. For higher transverse energies, the particles are no longer confined to one specific channel but may wander from channel to channel. In this case, the spectra are composed of ring-like distributions with highly structured azimuthal distributions and transverse energy-dependent radial distributions. Comparisons to theoretical predictions are made with the data. The spreading in the radical distributions is explained by inelastic multiple scattering. Dissert. Abstr.

N78-23949 California Univ., San Diego.
MAGNETIZATION AND MAGNETIC RELAXATION IN SUPERFLUID 3He Ph.D. Thesis
Ronald Eugene Sager 1977 162 p
Avail: Univ. Microfilms Order No. 78-05755

Longitudinal magnetic relaxation in superfluid He-3 was studied using an RF biased SQUID detector to provide continuous monitoring of the longitudinal relaxation following an RF tipping pulse. Experiments in both He-3-A and He-3-B were performed in a variety of magnetic fields and in three different geometries. Under certain conditions the longitudinal magnetization in He-3-A does not relax monotonically in time. Relaxation in He-3-B very near the critical temperature is shown to be remarkably different following 90 deg and 180 deg pulses and experiments using RF pulses with a time dependent frequency provide evidence for a negative frequency shift in He-3-B at large tipping angles in certain geometries. New measurements of the static magnetization of He-3-B were performed in various low magnetic fields and with the He-3-B in contact with a variety of wall configurations. The results are discussed in the context of previous measurements in both He-3-A and He-3-B. Dissert. Abstr.

N78-23950 Indiana Univ., Bloomington.
DIRECT OBSERVATION OF THE TWO-PHOTON GENERATION OF FREE EXCITONIC MOLECULES IN CuCl. INVESTIGATION OF THE ELECTRON-HOLE LIQUID PHASE IN II-VI SEMICONDUCTORS BY TRANSMISSION SPECTROSCOPY Ph.D. Thesis
Raymond Walter Svorec 1977 163 p
Avail: Univ. Microfilms Order No. 7805581

Two-photon absorption spectra due to excitonic molecule generation in thin CuCl samples at 4.2 K are directly measured using the intense light from a pulsed, frequency tunable dye laser. The induced absorption spectrum of CdS and CdSe in the wavelength region of the free and bound exciton lines was measured using a pulsed dye laser and differential transmittance

technique. The temperature dependence of the induced absorption spectrum in CdS was investigated. The spectrum of light absorption into an electron-hole plasma phase was calculated and compared with the experimentally determined absorption spectrum. A study of the photoconductivity of cadmium sulfide under dye laser excitation was performed. Dissert. Abstr.

N78-23951 Iowa State Univ. of Science and Technology, Ames.
ELECTROCATALYTIC ACTIVITY AND SURFACE PROPERTIES OF TUNGSTEN BRONZES Ph.D. Thesis
Michael Francis Weber 1977 175 p
Avail: Univ. Microfilms Order No. 7805977

The electrocatalytic activities of sodium tungsten bronzes, including high purity crystals, platinum doped crystals, and platinum plated crystals, were measured for oxygen reduction in acid solution, and compared with those of other alkali tungsten bronzes, thallium tungsten bronze, and tungsten trioxide. Doping the cubic sodium tungsten bronze with up to 800 ppm of platinum slightly increased the catalytic activity of the crystals. Platinum pre-electrolysis of the solution contaminated the crystal surface with significant amounts of platinum. For the platinum plated bronze crystals, no synergistic effect between the platinum and the bronze was observed for oxygen reduction. Different platinum plating methods gave more than an order of magnitude difference in catalytic activity, with the same amount of platinum.
Dissert. Abstr.

N78-23952 Pennsylvania Univ., Philadelphia.
QUASIPARTICLE-INJECTION-INDUCED SUPERCONDUCTING WEAK LINKS Ph.D. Thesis
Ting-wah Patrick Wong 1977 162 p
Avail: Univ. Microfilms Order No. 78-06660

Superconducting weak links are studied in which the weak region is created by locally driving the superconductor out of equilibrium using an independent source of quasiparticles. The characteristics of these weak links can be varied electrically or optically at any temperature below Tc. The Josephson coupling is enhanced by varying microbridge material and injection geometry. A simple model which describes the dependence of weak-line critical current, spatial quasiparticle distribution and energy gap suppression on quasiparticle-injection rate is presented. Dissert. Abstr.

N78-23953 Arizona Univ., Tucson.
EFFECTS OF CERTAIN PROCESSING VARIABLES ON STACKING FAULT FORMATION IN SILICON CRYSTALS Ph.D. Thesis
Yang-ming Chang 1977 220 p
Avail: Univ. Microfilms Order No. 7804906

Silicon single crystal wafers, phosphorus-doped, 4-6 ohm-cm, in the (100) orientation, and initially dislocation-free, were used in a study of the separate effects of HF treatments, chemical etching, and applied bending stresses on the growth of stacking faults as a result of steam oxidation treatments. Activation energies for stacking fault growth during oxidation, and for their shrinkage during nitrogen annealing were also determined. An activation energy of 4.6 ev was determined for the shrinkage of stacking faults when wafers with predeveloped stacking faults were subjected to an annealing treatment in an atmosphere of nitrogen. Dissert. Abstr.

N78-23954 Carnegie-Mellon Univ., Pittsburgh, Pa.
MODELING OF INTERNAL CENTRIFUGAL ZONE GROWTH Ph.D. Thesis
Robert Allen Hartzell 1977 215 p
Avail: Univ. Microfilms Order No. 7804934

The electric and temperature fields within inductively heated materials were calculated in order to better understand the essential features of the crystal growth process. It was found that electrical conductivities that increase with temperature like those of oxides are responsible for a heating instability. The modeling was able to predict that the instability can be controlled through a judicious choice of RF frequency, sample size, and sample doping. Another area of investigation was the effect of induction coil geometry and frequency on the shape of the solid/liquid interface. Solution of the time dependent differential equations for the electric and temperature fields, combined with an analysis of the RF generator/sample interaction, provided information concerning the formation of the initial melt zone, the relationship between generator meter readings and internal heating, and methods of control for future automation.
Dissert. Abstr.

N78-23955 Michigan Univ., Ann Arbor.
SOLID SOLUTIONS AND HARDNESSES OF BINARY COMPOUNDS WITHIN THE (Ca, Mn)/ (S,Se,Te) SYSTEM Ph.D. Thesis
Chi-Hung Leung 1977 175 p
Avail: Univ. Microfilms Order No. 7804750

This study examines the phase equilibria in the CaVI-MnVI (VI=S, Se, Te), CaS-CaSe, CaSe-CaTe, and CaS-CaTe systems. These compounds are encountered as nonmetallic inclusions in steels. This study should lead to a better understanding of the extents of solid solution in isomorphous compounds. Data are reported for some (Mn, Ca)S and (Mn, Ca)Se solids on the role of (1) solid-solution by cation substitution, (2) temperature, and (3) precipitation, upon hardness. Dissert. Abstr.

N78-23956 Cornell Univ., Ithaca, N. Y.
GRAIN BOUNDARY CAVITY GROWTH UNDER APPLIED STRESS AND INTERNAL PRESSURE Ph.D. Thesis
James Frank Mancuso 1977 183 p
Avail: Univ. Microfilms Order No. 7806336

Methane gas filled cavities were produced by the C + 4H yields CH4 reaction in the grain boundaries of type 270 nickel by hydrogen charging in an autoclave at 500 C with a hydrogen pressure of either 3.4 or 14.5 MPa. Intergranular fracture of nickel was achieved at a charging temperature of 300 C and 10.3 MPa hydrogen pressure. Cavities on the grain boundaries were observed in the scanning electron microscope after fracture. Photomicrographs of the cavities were produced in stereo pairs which were analyzed so as to correct for perspective distortion and also to determine the orientational dependence of cavity growth under an applied tensile stress. Dissert. Abstr.

N78-23957 State Univ. of New York, Stony Brook.
CLEAVAGE BEHAVIOR AS A FUNCTION OF COMPOSITION FOR SINGLE CRYSTALS OF THE Mo-Nb SYSTEM Ph.D. Thesis
Albert Thomas Pucino 1978 176 p
Avail: Univ. Microfilms Order No. 78-06884

Investigations were carried out in order to study the effect of alloying on the cleavage behavior of single crystals in the molybdenum-niobium system. Crystals of <001> tensile orientation, prepared by a modified EBZR growth technique, were precracked by spark erosion in a dielectric environment of liquid nitrogen. The crystals were subsequently tested in uniaxial tension at 77 K. Cleavage always occurred on the (001) planes. The stress-elongation curve remained linear up to the point of fracture. The appearance of the fracture surface was quite similar for Mo and the intermediate alloys. In general, there was a central spike region along <100> relatively free of deformation surrounded by regions of tearing and shearing. The extent of the region of deformation increased with increasing fracture stress for each of the alloy compositions. Dissert. Abstr.

N78-23958 Wayne State Univ., Detroit, Mich.
VACANCY FORMATION VOLUMES IN INDIUM AND CADMIUM FROM POSITRON ANNIHILATION MEASUREMENTS Ph.D. Thesis
John Ellis Dickman 1977 65 p
Avail: Univ. Microfilms Order No. 7805172

The zero-angle coincidence counting rate of the positron annihilation radiation was measured at various pressures between 10 and 80 kbar in order to determine the equilibrium vacancy formation volume. The vacancy formation volume obtained for indium at 498 K is 6.1 plus or minus 0.2 cu cm/mole which is 39 plus or minus 1% of the indium molar volume of 15.7 cm mole. The vacancy formation volume obtained for cadmium at 559 K is 5.7 plus or minus 0.4 cu cm/mole which is 44 plus or minus 3% of the cadmium molar volume of 13.0 cm/mole. These are the first measurements of the equilibrium vacancy formation volume in any metal and the first measurements of the vacancy formation volumes in indium and cadmium by any technique. The values obtained for the vacancy formation

volumes are in good agreement with results from quenching and diffusion studies. Dissert. Abstr.

N78-23959 California Univ., San Diego.
A POLARON MODEL OF GAS-SURFACE DYNAMICS Ph.D. Thesis
Timothy Ray Knowles 1977 124 p
Avail: Univ. Microfilms Order No. 78-05751

The theories of the sticking and accommodation coefficients for gases interacting with solid surfaces are reviewed. A nonperturbative approach, related to variational methods used in the polaron problem, is developed for the surface situation, and accounts for certain polarization effects of the lattice. An effective Hamiltonian is derived which involves a position dependent effective mass and a renormalized surface potential. An independent derivation of similar results, however lacking an important quantum effect, is presented based on a classical equation of motion method. Calculations for two models of the gas-surface interaction show that the dependent effect mass can be much greater than the bare mass of the gas atom. Agreement with low temperature data is obtained when the effective Hamiltonian is applied to problems of sticking and accommodation. Dissert. Abstr.

N78-23960 California Univ., San Diego.
SUPERCONDUCTING AND NORMAL STATE PHYSICAL PROPERTIES OF DILUTE ALLOYS OF LaSn3 CONTAINING LIGHT RARE EARTH IMPURITIES Ph.D. Thesis
Lance Eric DeLong 1977 349 p
Avail: Univ. Microfilms Order No. 7805743

The presence of anomalous values of the initial depression of the superconducting transition temperature with rare earth (RE) impurity concentrations in the case of dilute (LaRE)Sn3 alloys is addressed. The potential instability of the RE impurity 4f electron shell to hybridization with host conduction electron states is emphasized. It is demonstrated that (LaSm)Sn3 alloys constitute the first example of a dilute alloy containing Sm impurities which intrinsically possess an unstable 4f shell. The existence of long-range interimpurity magnetic interactions in (LaRE)Sn3 alloys is also demonstrated. The potential influence of aspherical Coulomb and anisotropic exchange scattering of conduction electrons by RE impurities, and impurity intra-4f shell Coulomb correlation effects are discussed in relation to the experimental behavior of (LaRE)Sn3 alloys. Dissert. Abstr.

N78-23961 State Univ. of New York, Stony Brook.
PROPERTIES OF SUPERCONDUCTING THIN-FILM MICROBRIDGES Ph.D. Thesis
Shin-Shem Pei 1978 92 p
Avail: Univ. Microfilms Order No. 78-06889

The dependences of critical current and current phase relation on the dimensions of a superconducting thin-film microbridge are investigated. A model was developed upon the Volkov's hyperbolic bridges and the Zaitsev's boundary conditions to calculate the spatial variation of the order parameter for given bridge dimensions. The critical current density of the bridge was calculated also as a function of the bridge dimensions. Direct measurements were made on the current phase relation of indium bridges with width smaller than 0.6 microns. The difficulties due to the extra phase shifts from the series thin film electrodes are overcome by a specially designed double loop configuration which has an extra low effective inductance. The intrinsic noise of a superconducting ring closed by a submicron tin bridge was also measured. The magnitude of the intrinsic noise is found to be the same as that of an ideal Josephson junction.
Dissert. Abstr.

N78-23962 Northwestern Univ., Evanston, Ill.
MICROSCOPIC THEORY OF PHASE TRANSITIONS: CLASSICAL STATISTICAL MECHANICS OF LIQUID CRYSTALS AND QUANTUM MECHANICS OF ADSORBED GASES Ph.D. Thesis
Michael Alan Lee 1977 134 p
Avail: Univ. Microfilms Order No. 7805294

The occurrence and properties of phases of anisotropic systems were investigated. Broadly two areas were considered: one classical-liquid crystals, and the other quantum-light atoms and molecules physically adsorbed on substrate surfaces. Both problems require formulations involving coupled nonlinear integral equations and their solutions to determine the correlation functions for the system. In the case of liquid crystals, a model was constructed by assuming an anisotropic pair interaction and the Bogoliubov-Born-Green-Kirkwood-Yvon (BBGKY) hierarchy of integral equations was employed. The properties of adsorbed gases were calculated. In the first case the possibility of spontaneous crystallization of helium in two dimensions was investigated. An extensive calculation involving the properties of molecular hydrogen on a graphite substrate was performed.
Dissert. Abstr.

N78-23963 North Carolina Univ., Chapel Hill.
MOESSBAUER STUDY OF EU-AND DY-DOPED FLUORITE CRYSTALS Ph.D. Thesis
Chiun-Shiung Kuo 1977 99 p
Avail: Univ. Microfilms Order No. 7807143

Moessbauer studies were carried out for Eu and Dy doped into the fluorites CaF2, SrF2 and BaF2 as well as of Dy2O3. The objective was to clarify the defect stabilization of the rare earth, particularly by oxygen stabilization. The Moessbauer quadrupole interaction for Dy(+3) in Dy2O3 and CaF2 (virgin and oxygen-injected) was measured between 90 K and 630 K. The Dy2O3 data agrees with known crystal and atomic parameters. Comparisons of the experimental data with theoretical calculations confirm that in oxygen-free CaF2 the stabilization occurs via an interstitial F(-) ion, while heat treatment leads to charge stabilization by oxygen substitutionally replacing a F(-) ion. Possible significant disagreements with crystalline-field and Sternheimer shielding parameters for dilute doping levels are discussed.
Dissert. Abstr.

N78-23964 Illinois Univ., Urbana-Champaign.
DESORPTION AND SURFACE DIFFUSION: NITROGEN ON TUNGSTEN (110) Ph.D. Thesis
Anthony James Polak 1977 167 p
Avail: Univ. Microfilms Order No. 78-04116

Scanning Auger spectroscopy was used to monitor the migration of nitrogen atoms down a concentration gradient, on the (110) plane of tungsten. The desorption kinetics of both molecular and atomically bound nitrogen were studied by a combination of Auger spectroscopy and flash absorption. The desorption of atomically bound nitrogen occurs as a second order process with an activation energy more than 7 times the activation energy of diffusion. Despite the large binding energy of the atomic nitrogen to the (110) surface, 153 kcal/mole, there is virtually no change in the work function upon adsorption. In addition the saturation coverage of the irradiated atomic nitrogen is found to be more than twice that of the nitrogen adsorbed at room temperature. Both are found to be in identical binding states.
Dissert. Abstr.

N78-23965 California Univ., San Diego.
CONTRIBUTIONS TO THE ELECTRON THEORY OF SOLID INTERFACES Ph.D. Thesis
Cheng-Chih Pei 1977 130 p
Avail: Univ. Microfilms Order No. 78-05753

The thesis is divided into the two following parts: (1) the perturbation of electronic structure of insulators by interfaces and a defect; (2) the interface energies - in particular the stacking fault energy of solid nickel. A theory is extended for a one-dimensional non-periodic system to develop a theory that describes how the electronic density distribution near an insulator-insulator interface approaches the bulk behavior. A practical scheme is developed for the calculation of interface energies. The stacking fault energy of nickel is calculated using tight binding type Wannier functions for the d-electrons and ignoring the effect of the s-electrons. The d band degeneracy is fully taken into account. The method also allows one to handle charge transfer effects: a stacking fault perturbation potential is included and calculated quasi-self-consistently. Comparisons are made between the moment scheme, the consistent scheme and the self-consistent scheme. Dissert. Abstr.

N78-23966 California Univ., San Diego.
MAGNETIC BEHAVIOR OF SOLID He-3 AT ITS NUCLEAR ORDERING TEMPERATURE Ph.D. Thesis
Thomas Cortelyou Prewitt 1977 110 p

Avail: Univ. Microfilms Order No. 7805754

Through the use of nuclear adiabatic demagnetization of copper He-3 solid was cooled to below its 1.1 mK nuclear ordering temperature. A static measurement of the He-3 magnetization showed that magnetization larger than predicted by a simple Curie Weiss model above T, decreases sharply at T, and is temperature independent below T. Samples both on and slightly off the melting curve were studied. The results are in qualitative agreement with the other experimental results on solid He-3, but not with the present theoretical models. Dissert. Abstr.

N78-23967 California Univ., Santa Cruz.
RENORMALIZATION TRANSFORMATIONS FOR QUANTUM SPIN SYSTEMS Ph.D. Thesis
Frederick Harris Kuttner 1977 66 p
Avail: Univ. Microfilms Order No. 7804538

An operator renormalization transformation is proposed for quantum spin systems which is manifestly basis independent and preserves the fundamental symmetries of the spin Hamiltonian. The transformation is applied to the one and two dimensional spin-1/2 anisotropic Heisenberg models in a finite lattice approximation. The free energy of the one-dimensional X-Y model is calculated. The free energy, internal energy and specific heat are computed along this axis and are in good agreement with high temperature series results. The shape of the critical line in the region dominated by the Ising fixed point does not correspond to that calculated from high temperature series or from a cumulant renormalization transformation. This discrepancy is linked to problems with the low-temperature behavior of the transformation. Dissert. Abstr.

N78-23968# Electrotechnical Lab., Tokyo (Japan).
ELECTRONIC STRUCTURES OF THE TRANSITION METAL CARBIDES AND BORIDES STUDIED BY X-RAY PHOTOELECTRON SPECTROSCOPY AND BAND CALCULATION
Hideo Ihara Dec. 1977 128 p refs In JAPANESE; ENGLISH summary
(Rept-775) Avail: NTIS HC A07/MF A01

Previous band models of the transition metal carbides and borides are reviewed. The atomic structures of transition metal carbides (TiC, ZrC, HfC, VC, NbC and TaC), borides (TiB2 and ZrB2), and some related materials (Ti, Zr, CaB6 and LaB6) are studied by the interplay between X-ray photoelectron spectroscopy (XPS) and augmented plane wave (APW) calculation. Topics covered include: (1) APW band calculation and results; (2) XPS study of the densities of state; (3) band structures and related physical properties; (4) chemical shifts and charge transfer; and (5) application of the transition metal carbides to the solar selective surface. Author

N78-23969*# National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD OF CONTROLLING DEFECT ORIENTATION IN SILICON CRYSTAL RIBBON GROWTH Patent Application
Martin H. Leipold, inventor (to NASA) (JPL) Filed 16 Jul. 1976 11 p
(Contract NAS7-100)
(NASA-Case-NPO-13918-1; US-Patent-Appl-SN-706073) Avail: NTIS HC A02/MF A01 CSCL 20B

An invention is presented that is directed to controlling the orientation of anomalies such as twinning defects in crystal silicon ribbon for use in fabricating solar cells on a commercial basis. The novelty of the invention resides in the use of a starting seed crystal having a specific (110) crystallographic plane and <112> crystallographic direction determinable by conventional X-ray diffraction techniques in order that anomalies occur parallel to the length of the ribbon. Without such seed crystal, anomalies occur randomly and in an uncontrolled manner, and as much as five feet of ribbon crystal may be grown before the anomalies stabilize in the preferred orientation. NASA

N78-23970# Stanford Univ., Calif. Stanford Electronics Labs.
STUDY OF THE ELECTRONIC SURFACE STATE OF III-V COMPOUNDS Semi-annual Technical Progress Report
W. E. Spicer 15 Sep. 1977 131 p refs
(Contract DAAK02-74-C-0069; DARPA Order 2182)
(AD-A051698) Avail: NTIS HC A07/MF A01 CSCL 20/12

Activities during this period included the following: (1) We finished assembling and used our new vacuum system in a number of experiments. This system gives us the capability of doing photoemission, Auger spectroscopy, and LEED on a sample that can be prepared by cleaving, heat cleaning, or ion bombardment and annealing. We also have evaporators (gold and cesium) in the system (see section on future plans for planned additions to this system). (2) We started developing the software for our new computer system. This work is progressing quite well. (3) We continued our work on developing the capability of heat cleaning GaAs surfaces. GRA

N78-23971# California Univ., Santa Barbara. Dept. of Electrical Engineering.
THEORY OF HETEROJUNCTION DISCONTINUITIES Final Technical Report, 1 Nov. 1976 - 31 Dec. 1977
Herbert Kroemer Jan. 1978 21 p refs
(Grant DAAG29-77-G-0017)
(AD-A051991; ARO-14731.3-EL) Avail: NTIS HC A02/MF A01 CSCL 20/12

Earlier self-consistent pseudopotential calculations of heterojunction band lineups were refined. A rational electrostatic potential matching scheme was developed, involving the mean interstitial potential of the two semiconductors, shifted by a dipole contribution calculable from electronegativity data. A model for small crystallographic anisotropics is described. Author (GRA)

N78-23972# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering.
STANNIC OXIDE SEMICONDUCTOR STUDIES Final Scientific Report
C. G. Fonstad 15 Feb. 1978 11 p refs
(Grant AF-AFOSR-2493-73)
(AD-A051973; AFOSR-78-0418TR) Avail: NTIS HC A02/MF A01 CSCL 20/12

High quality stannic oxide epilayers were grown in TiO2 substrates without evidence of thermal mismatch. Electrical characterization was performed and device applications were studied. Stannic oxide appears to be suitable for high temperature microwave Schottky barrier field effect transistors. Author (GRA)

N78-23973# Stanford Univ., Calif. Electronics Lab.
STUDIES OF THE SURFACE ELECTRONIC STRUCTURE AND CHEMISTRY OF Si, Ge AND OTHER SOLIDS Final Report, 1 Jun. 1974 - 30 Nov. 1977
W. E. Spicer 30 Jan. 1978 9 p refs
(Grant DAHC04-74-G-0215)
(AD-A051970; ARO-12350.6-P) Avail: NTIS HC A02/MF A01 CSCL 20/12

The surface electronic structure and certain aspects of the surface chemistry of amorphous and crystalline Si and Ge as well as crystalline SrTiO3 ZnO, and Sn have been studied using photoemission spectroscopy and Auger electron spectroscopy. By examining the surface, valence, and core states a more detailed picture of the surface electronic structure and chemistry could be obtained than has been generally possible in the past. Of particular importance has been the use of Stanford Synchrotron Radiation Laboratory which has provided continuously tunable radiation from 10 to 300 eV. Using this capability, it is possible, for example, to examine the surface states and core levels as a gas is adsorbed. It has been found possible to adsorb oxygen on Si in such a way that the surface states are removed but the usual shift in the Si 2p core level associated with chemical bonding is missing. This indicates a new type of 'covalent' bonding, previously unexpected. These results can give new insight into the kinetics of oxygen takeup on Si. GRA

N78-23974# University of Southern Calif., Los Angeles. Dept. of Materials Science.
THE STRUCTURAL CHARACTERISTICS OF RADIATION DAMAGE PRODUCED BY HIGH ENERGY (2.7 MeV) ION IMPLANTATION IN GaAs Interim Report
G. H. Narayanan and W. C. Spitzer 1977 28 p refs
(Contract F44620-76-C-0061; AF Proj. 2305)
(AD-A051988; AFOSR-78-0407TR) Avail: NTIS HC A03/MF A01 CSCL 20/12

Ion implantation of dopant atoms has now been successfully employed to produce both p-type and n-type layers on GaAs substrates. High energy implantation, however, introduces

considerable damage to the host lattice, the extent of which is determined by the mass, energy and dose of the implanted ions, the mass of the target atoms as well as the temperature of the target. In extreme cases, the atomic disorder in the implanted region can be sufficiently great as to cause crystalline-to-amorphous transitions to occur. Any impurity conduction effect arising from the electrical (doping) characteristics of the implanted ion is generally completely masked by the damage. Therefore the damage must be annealed out by appropriate post-implantation heat treatment which will reduce the residual defects to a level where carrier mobilities and lifetimes are usefully large and the implanted ions will be incorporated into electrically active sites in the crystal lattice. Thus, it is of great interest to study the nature of implantation induced damage as a function of implantation conditions and the recovery of the damage during post implantation annealing. GRA

N78-23975# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mechanical Engineering, Aeronautical Engineering and Mechanics.

ON INTEGRAL FORMS OF THE BALANCE LAWS FOR DEFORMABLE SEMICONDUCTORS

M. F. McCarthy (Univ. Coll., Galway, Ireland) and H. F. Tiersten Feb. 1978 19 p refs

(Contract N00014-76-C-0368; Grant NSF ENG-72-04223; NR Proj. 318-009)

(AD-A052050; TR-23) Avail: NTIS HC A02/MF A01 CSCL 20/12

The general nonlinear differential equations describing the interaction of finitely deformable, polarizable, heat conducting intrinsic n-type semiconductors with the quasi-static electric field are transformed from the unknown present coordinate description to the known reference coordinate description, which is the form needed in the treatment of problems. From the differential form of each balance equation in the reference coordinate description, the associated integral form is obtained. The resulting integral forms turn out as expected with the exception of the one due to the balance of linear momentum for the semiconducting fluid, in which an important change in and simplification from the form used heretofore is introduced. The previous existing integral form of the equation of the balance of energy in the present coordinate description is transformed to a different form, which is equivalent to the original form only when the field variables are differentiable. The revised integral form in the present coordinate description is then transformed to the reference coordinate description, from which an energetic jump condition across a moving non-material surface of discontinuity is obtained which is consistent with all the other jump conditions obtained from the other integral forms. GRA

N78-23976# Argonne National Lab., Ill.

ANL EXPERIMENTAL PROGRAM FOR PULSED SUPERCONDUCTING COILS

S. T. Wang, S.-H. Kim, W. F. Praeg, and C. I. Krieger 1977 6 p refs Presented at 7th Symp. on Fusion Res. Proj., Knoxville, Tenn., 25-28 Oct. 1977

(Contract W-31-109-eng-38)

(CONF-771029-184) Avail: NTIS HC A02/MF A01

The clear advantage of a superconducting ohmic-heating (OH) coil prompted an aggressive program to develop cryostable basic cable configurations with reasonably low ac losses, to develop 12 kA cryostable cable, using it to design and build a 1.5 MJ pulsed coil, and to develop a rather inexpensive large fiberglass reinforced helium cryostat for the 1.5 MJ pulsed coil. The 1.5 MJ ac coil was built to demonstrate ac cryostability of a large coil ranging from 2 T/s up to 12 T/s, to determine the feasibility of parallel coil operation in order to avoid excessive voltage and current requirements and to minimize the number of turns for the equilibrium field (EF) coils, should the EF coils be connected in parallel with the OH coils. A two-coil section model using the 11 kA cable will be built and tested. ERA

N78-23977# Oak Ridge National Lab., Tenn.

HELIUM DISTRIBUTION SYSTEM FOR THE LARGE COIL TEST FACILITY (LCTF)

C. G. Lawson and J. R. May (Grumman Aerospace Corp., Bethpage, N. Y.) 1977 4 p refs Presented at 7th Symp. on Fusion Res. Proj., Knoxville, Tenn., 25-28 Oct. 1977

(Contract W-7405-eng-26)

(CONF-771029-193) Avail: NTIS HC A02/MF A01

The refrigeration and liquefaction requirements for the large coil test facility are discussed including both the usual cooldown, lead cooling, thermal conduction and radiation, and joule heating losses, and the unusual losses due to simulated nuclear heating, magnetic coupling losses due to the transient fields of the driving magnets, and pumping losses due to fluid resistance and pump inefficiency. The flow system is designed with separate cooldown and steady-state flow systems, and to simultaneously circulate helium under steady-state conditions through coils cooled by boiling liquid or supercritical helium at approximately 4.0 K and greater than or equal to 2.5-atm pressure. Separate helium storage dewars are utilized for vapor cooling of the current leads to the magnets with the effluent gas being stored after compression in high pressure storage tanks. The flow diagram is presented in simplified form to show the salient features of the cryogenic system. ERA

N78-23978# Argonne National Lab., Ill.

LIMITS ON THE FIELD OF OHMIC HEATING SOLENOIDS, APPLIED TO A TOKAMAK TNS

Larry R. Turner 1977 7 p refs Presented at 7th Symp. on Fusion Res. Proj., Knoxville, Tenn., 25-28 Oct. 1977

(Contract W-31-109-eng-38)

(CONF-771029-199) Avail: NTIS HC A02/MF A01

If the ohmic heating solenoid for the TNS or other large Tokamak is an ungraded cryostable superconducting solenoid, with NbTi at 4.2 K as the superconductor, then the smallest outer diameter is not achieved at the highest attainable field. There is a lower optimum field which minimizes the outer diameter for a given volt-second requirement. At higher fields the mean diameter decreases; but the high fields require more superconductor, more copper stabilizer, more stainless steel for support, and more liquid helium coolant. For the GA-ANL design for TNS, the optimum field is 7.55 T and the minimum outside diameter for the solenoid is 2.15 m. If, on the other hand, the solenoid is graded, with more NbTi, copper, and stainless steel on the inner turns where the field is higher, then the volt-seconds can always be increased, for a given outer diameter, by adding more turns at a higher field inside until either the critical field is reached or the solenoid bore is filled. ERA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N78-23979# Chalmers Univ. of Technology, Goteborg (Sweden). Inst. of Theoretical Physics.

[ACTIVITIES OF THE INSTITUTE OF THEORETICAL PHYSICS] Annual Report, 1976

1977 60 p refs

Avail: NTIS HC A04/MF A01

Activities of groups working in elementary particle physics; condensed material physics; and mathematized physics are summarized. Staff, teaching awards; and publications are listed. ESA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N78-23980 Michigan Univ., Ann Arbor.
A SCHEDULING METHODOLOGY FOR COMPUTER OPERATIONS Ph.D. Thesis
Kuchibhatla Sundar Das 1977 237 p
Avail: Univ. Microfilms Order No. 7804676

This research is concerned with the classification and evaluation of job scheduling strategies in a large-scale data processing center with a third generation multiprogramming computer. A new job scheduling algorithm, the Modified Wilkerson-Irwin (MWI) algorithm, is developed to incorporate the tradeoffs between the two conflicting performance measures, job costs and system costs. When applied to a serial processing system it is shown to yield near-optimal solutions for the combined objective functions of job and system costs, and yet has low computational complexity. The MWI algorithm is extended to produce several other job scheduling algorithms for batched multiprogramming computers, and their performance is evaluated against some well known job scheduling algorithms. Dissert. Abstr.

N78-23981# Defense Systems Management School, Fort Belvoir, Va.
A PROPOSED MINI-MANAGEMENT INFORMATION SYSTEM FOR THE PROGRAM MANAGER FOR AVIONICS NAVAL AIR SYSTEMS COMMAND HEADQUARTERS
Benjamin F. Short Nov. 1977 43 p refs
(AD-A052113) Avail: NTIS HC A03/MF A01 CSCL 05/2

The report describes selected functions within the Avionics Division of the Naval Air Systems Command Headquarters which could be incorporated into a computer base mini-Management Information System (MIS). The data and information upon which to base the report was derived from interviews, books and articles on MIS, and personal experience having been assigned to the Avionics Division. If a computer were to be made available to the Division to execute the MIS functions, the Division Director/Program Manager for Avionics would be better able to track the cost, schedule, and technical performance of the many assigned projects. Additionally, many administrative functions could more efficiently be performed if incorporated into the computer/MIS. With more complete information available, the Division director/PM could more efficiently manage the assigned projects. Author (GRA)

N78-23982# European Space Agency, Paris (France). Project Control Div.
PROJECT CONTROL REQUIREMENTS AND PROCEDURES FOR MEDIUM-SIZE CONTRACTS
Dec. 1977 52 p refs
(ESA-PSS-38-Issue-1) Avail: NTIS HC A04/MF A01

Project control requirements and procedures for medium-sized contracts are stipulated. These were evaluated from discussions held and agreements reached during a series of working-group meetings between ESA and Eurospace on project control, held during 1976 and 1977. These requirements take into account the experience gained with the project control methods applied to procurement actions in which the rate of expenditure ranged from 250,000 to 5,000,000 Accounting Units (AU) per year. Author (ESA)

N78-23983# European Space Agency, Paris (France). Project Control Div.
PROJECT CONTROL REQUIREMENTS AND PROCEDURES FOR SMALL CONTRACTS
Dec. 1977 36 p
(ESA-PSS-39-Issue-1) Avail: NTIS HC A03/MF A01

Project control requirements and procedures for small contracts are stipulated. These were evolved from discussions held and agreements reached during a series of working-group meetings between ESA and Eurospace on project control, held during 1976 and 1977. These requirements take into account the experience gained with project control methods applied to procurement actions in which the rate of expenditure ranged from about $50,000 to $250,000 per year. Author (ESA)

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N78-23984 Ohio State Univ., Columbus.
A METHODOLOGY FOR IDENTIFYING INFORMATION SYSTEM DESIGN REQUIREMENTS BASED ON THE ASSESSMENT OF MULTIPLE USER PERFORMANCE CRITERIA Ph.D. Thesis
John Steven Chandler 1977 242 p
Avail: Univ. Microfilms Order No. 78-05824

A methodology was developed that established a formal liaison between the evaluation of user goals as a function of system activity and the evaluation of resource utilization as a function of user demand. This liaison was used to identify the performance levels of information system activities required to satisfy both criteria. This research was part of a three stage iterative design methodology comprised of a system evaluation stage, user evaluation stage and a design evaluation stage. Each stage in this overall methodology employed a different evaluative technique. These were, respectively, the IPSS simulator to model and measure system activity, multiple goal programming to evaluate user goals and to identify required activity performance levels, and heuristic procedures to determine design modifications to improve performance. Dissert. Abstr.

N78-23985# California Univ., Livermore. Lawrence Livermore Lab.
DATA CHARACTERIZATION AND COMPRESSION
E. K. Miller 6 Jul. 1977 24 p refs Sponsored by ARPA, AFWL, the US Bureau of Mines and DNA
(Contract W-7405-eng-48)
(UCID-17511) Avail: NTIS HC A02/MF A01

An information-transformation process based upon Prony's method was found to be increasingly useful for application to electromagnetic-type problems in particular and a growing variety of physical problems in general. This procedure allows the coefficients and exponents (or parameters) of an exponential series to be derived from a sequence of its sampled values. Two basic issues are associated with Prony processing: determination of the status of the input data and application of the procedure as effectively as possible to maximize the information content of the output. The possible uses of the Prony method as an information on-transformation process are discussed; the insight gained from this viewpoint concerning the information content of data is emphasized. Waveform and spectrum characterization, data compression, and inversion of pattern data are considered briefly as applications. Author (ERA)

N78-23986# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AERONAUTICAL KNOWLEDGE, SELECTED ARTICLES
Chii Fan and Kuo Fang Tsing 30 Nov. 1977 16 p Transl. into ENGLISH from Hang K'ung Chih Shih (China), no. 3, Mar. 1977 p 22-23 and 34-35
(AD-A051710; FTD-ID(RS)T-1986-77) Avail: NTIS HC A02/MF A01 CSCL 01/2

Contents: Weather and Aviation Safety -- A sketch on a Civilian Plane Trip; and Earthquake Prediction by Artificial Satellites. GRA

N78-23987# California Univ., Livermore. Lawrence Livermore Lab.
INFORMATION EXTRACTION USING PRONY'S METHOD
E. K. Miller and D. L. Lager 23 Aug. 1977 19 p refs
(Contract W-7405-eng-48)
(UCRL-52329) Avail: NTIS HC A02/MF A01

Prony's method is a technique for determining the coefficients

(poles and residues in the frequency domain) of an exponential series. Prony's method offers insight into the general problem of extracting useful information from one-dimensional data. In particular, Prony's method can be viewed as a transformation of data from one form to another. The amount of information extractable from transformed data can be as much as or less than that in the original data. This report considers these questions of information content and data transformation. To study data transformation, a waveform is defined in terms of specified poles and residues, the waveform is sampled to obtain the associated data, and Prony's method is used to transform the data and compare it with the original information content. Finally, applications of Prony's method to other physical problems with exponential solutions are briefly considered. ERA

N78-23988# Mound Lab., Miamisburg, Ohio.
INTERACTIVE DATA MANAGEMENT AND ANALYSIS SYSTEM FOR THE EASTERN GAS SHALE PROGRAM
Purtle W. Seabaugh and Ronald E. Zielinski 1977 8 p refs Presented at the Eastern Gas Shale Program Conf., Morgantown, W.Va., 17 Oct. 1977
(Contract EY-76-C-04-0053)
(MLM-2469(OP); Conf-771038-5) Avail: NTIS HC A02/MF A01

A versatile, easy to use data base system is described. The system provides flexibility in display formats as well as input and output options such as format compatibility adaptive to field data. Versatility is attained through logical, Boolean, and arithmetic expressions. Consequently, computational capability is available so that data input can be minimized. Browsing and recursive searches are available through a search criteria command that allows the user to modify and narrow the request without restart. The system provides plotting options; data can be plotted in a well profile format. Through GEOLOG, a softwired synergistic log system, well log data can be integrated with geochemical and geophysical experimental data. This integration will provide a more accurate assessment of the resources potential of the well. Utilization of these features provides not only a fully interactive data management system but also an enhanced statistical capability for data analysis. ERA

N78-23989# National Bureau of Standards, Washington, D. C. Library Div.
IMPACT OF THE NEW COPYRIGHT LAW ON INTERLIBRARY LOAN IN A RESEARCH LIBRARY
Elsie Cerutti and Jane C. Tucker Jan. 1978 21 p refs
(PB-276907/3; NBSIR-78-1427) Avail: NTIS HC A02/MF A01 CSCL 05B

A study of interlibrary loan borrowing at the National Bureau of Standards Library in 1976 was made, to forecast the impact of the new copyright law on the Library budget. The study indicates that the majority of journals are requested only once, and that a number of foreign journals are requested. An analysis of subscription cost compared to interlibrary loan cost suggests criteria for management decisions on subscription, as well as testing the fairness of the CONTU guidelines in their economic impact on libraries. GRA

N78-23990# National Library of Medicine, Bethesda, Md. MEDLARS Management Section.
NLM ON-LINE SERVICES REFERENCE MANUAL
Jan. 1978 495 p Revised
(PB-277167/3; NLM-MED-78-01) Avail: NTIS HC E08/MF A01 CSCL 05B

A comprehensive manual for the operation of the various NLM on-line data bases is presented. Specific information on modes of accessing these data bases, the commands which may be used, techniques for searching them are included. Instructions on the use of MEDLINE, SDILINE, CATLINE, AVLINE, Name Authority File, SERLINE, TOXLINE, CHEMLINE, RTECS, TDB, CANCERLIT, CANCERPROJ, CLINPROT, EPILEPSY, and MEDLEARN are given. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N78-23991# Committee on Interstate and Foreign Commerce (U. S. House).
REGULATION OF CANCER-CAUSING FLAME-RETARDANT CHEMICALS AND GOVERNMENTAL COORDINATION OF TESTING OF TOXIC CHEMICALS
Washington GPO 1977 527 p refs Hearings before Subcomm. on Oversight and Investigations of the Comm. on Interstate and Foreign Commerce, 95th Congr., 1st Sess., 11, 13, and 16 May 1977
(GPO-92-727) Avail: Subcomm. on Oversight and Investigations

Professionals from the scientific community, both public and private sectors, testify on the role of flame-retardant and toxic chemicals enhancement of cancer. The primary concern of the hearing was the evaluation of the use of the chemical Tris in wearing apparel. Test data are presented for various toxicity tests performed with potential cancer causing chemicals. A Bill is proposed to handle payments for losses incurred as a result of the ban on the chemical Tris. Coordinating efforts are recommended for the testing of toxic chemicals. G.Y.

N78-23992# Committee on Banking, Housing and Urban Affairs (U. S. Senate).
NATIONAL ENERGY CONSERVATION POLICY ACT
Washington GPO 1977 385 p refs Hearings on S. 1469 before Comm. on Banking, Housing, and Urban Affairs, 95th Congr., 1st Sess., 27-29 Jun. 1977
(GPO-94-843) Avail: Comm. on Banking, Housing, and Urban Affairs

Representatives from Government and private agencies met to discuss and propose a Bill on energy conservation in residential buildings. Of primary concern was the use of insulations to control energy use and how through Government and private loans and tax incentives this program could be implemented. The proposed Bill was outlined as follows: Part 1 - Energy Conservation for Existing Residential Buildings - Utility Program, Financing Program; Part 2 - Energy Efficiency of Consumer Products - Energy Efficiency Standards for Consumer Products other than Automobiles, Disclosure of Automobile Fuel Efficiency Tax, and Disclosure of Automobile Fuel Efficiency Rebate; Part 3 - Energy Conservation Program for Schools and Hospitals; Part 4 - Natural Gas; Part 5 - Public Utility Regulatory Policies - General Provisions, National Electric Rate Design Policies, Bulk Power Supply, Natural Gas Rate Design Policies; Part 6 - Amendments to the Energy Supply and Environmental Coordination Act; Part 7 - Federal Energy Initiatives - Federal Vanpooling Program, Amendments to Section 381 of the Energy Policy and Conservation Act, Demonstration of Solar Heating and Cooling in Federal Buildings. G.Y.

N78-23993# European Space Agency, Paris (France).
BASIC TEXTS OF THE EUROPEAN SPACE AGENCY. VOLUME 1: CONVENTIONS AND RULES
1 Sep. 1977 204 p 2 Vol.
Avail: NTIS HC A10/MF A01

The ESRO (European Space Research Organization) and ESA (European Space Agency) conventions, rules, and procedures of delegate bodies such as the Council, the Administrative and Finance Committee (AFC), the Industrial Policy Committee (IPC), the program boards and advisory groups, and the implementing rules concerning ESRO facilities, flying passengers and the Ariane

vehicles, general instrumentation for the first Spacelab mission, intellectual property rights, and scientific and technical information are presented. ESA

N78-23994# European Space Agency, Paris (France).
BASIC TEXTS OF THE EUROPEAN SPACE AGENCY. VOLUME 2: AGREEMENTS RELATING TO FACILITIES AND ACTIVITIES
1 Sep. 1977 522 p 2 Vol.
Avail: NTIS HC A22/MF A01

Arrangements, agreements, and other texts relating to the programs of the European Space Agency are presented. The texts are classified under facilities, tracking network, programs (Aerosat, Ariane, Earthnet, Esrange, ISEE, IUE, Marots, Meteosat, Telecom, Space Telescope), and other agreements. ESA

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N78-23995 Ohio State Univ., Columbus.
AN EVALUATION OF ALTERNATIVE MANUAL LANDUSE FORECASTING METHODS USED IN TRANSPORTATION PLANNING Ph.D. Thesis
Clement Jotindrakumar Khisty 1977 200 p
Avail: Univ. Microfilms Order No. 78-05866

This dissertation explores, examines and evaluates landuse forecasting and distribution methods used in urban transportation planning. A holistic approach is taken to investigate the role of the landuse model in the overall planning framework. This overview concludes with a critique of current landuse modeling practice vis-a-vis the requirements of the transportation planning process. Based on a literature survey of current landuse planning practice, an evaluation of alternative landuse models is made, oriented to basically traditional manual procedures. The main thrust of this investigation is focused on methods of allocating regional totals of population, economic activity and landuse to small areas such as planning areas, census tracts and traffic zones. Dissert. Abstr.

N78-23996 Northwestern Univ., Evanston, Ill.
CHARACTERISTICS AND EFFECTIVENESS OF STIGEOCLONIUM SP IN WASTEWATER TREATMENT Ph.D. Thesis
Shuang-Shih Liu 1977 145 p
Avail: Univ. Microfilms Order No. 78-05299

The growth characteristics of filamentous alga Stigeoclonium sp were investigated with respect to light intensity, temperature, carbon dioxide supply, pH value of the medium and size of the algal inocula. The experiments are described and the data from twenty three experiments are presented. The relative growth rate of the first order growth model was calculated for each experiment. The effectiveness of S. sp in wastewater treatment and nutrient reclamation was studied. Experiments employing the hanging plates pilot plant and the rotating disks pilot plant are described. The ability of S. sp to grow attached on both glass and plastic surfaces was demonstrated. The algal yield and the removal efficiency of pollutants such as BOD, COD and org-N were studied with respect to various hydraulic detention times. Dissert. Abstr.

N78-23997 Utah State Univ., Logan.
A MATHEMATICAL MODEL FOR OPTIMIZING CHLORINATION OF WASTE STABILIZATION LAGOON EFFLUENT Ph.D. Thesis
Bruce Allen Johnson 1977 290 p
Avail: Univ. Microfilms Order No. 77-30647

Chlorination disinfection practices performed on waste stabilization lagoon effluents were and are being considered as a solution to bacterial removal prior to discharge to receiving waters. Chlorination test facilities were constructed at the Logan, Utah sewage lagoons. Chlorination studies on primary and secondary, as well as filtered and unfiltered, lagoon effluents were conducted at these facilities between August 1, 1975 and August 24, 1976. Lagoon performance in removing bacteria was also evaluated at this time. The model was used to predict the chlorine dosages necessary to achieve adequate disinfection for varying effluent characteristics. A series of design curves were constructed from the model for use in selecting the optimal chlorine dosages necessary for achieving prescribed levels of disinfection. Dissert. Abstr.

N78-23998 Connecticut Univ., Storrs.
THE DEVELOPMENT OF AN INTEGRATED SYSTEM FOR WATER QUALITY MANAGEMENT PLANNING Ph.D. Thesis
Joseph Edgar Sarsenski 1978 229 p
Avail: Univ. Microfilms Order No. 7806147

The objective of the work reported on in the thesis was to develop an interactive system of tools and models which allow water quality management planners to fully analyze the interrelationships of the various management elements and to display to decision-makers the impacts of changes in any one element. Management elements considered included land use patterns, water uses, water quality criteria, wastewater generation rates, wastewater transport systems, and wastewater treatment systems. The development of the planning tools was applied to the James River Basin in the Commonwealth of Virginia. Dissert. Abstr.

N78-23999*# Joint Center for Graduate Study, Richland, Wash.
STIRLING ENGINE DESIGN MANUAL Final Report
William R. Martini Apr. 1978 369 p refs
(Grant NsG-3152; Contract EC-77-A-31-1011)
(NASA-CR-135382; DOE/NASA/3152-78/1) Avail: NTIS HC A16/MF A01 CSCL 21G

This manual is intended to serve both as an introduction to Stirling engine analysis methods and as a key to the open literature on Stirling engines. Over 800 references are listed and these are cross referenced by date of publication, author and subject. Engine analysis is treated starting from elementary principles and working through cycles analysis. Analysis methodologies are classified as first, second or third order depending upon degree of complexity and probable application; first order for preliminary engine studies, second order for performance prediction and engine optimization, and third order for detailed hardware evaluation and engine research. A few comparisons between theory and experiment are made. A second order design procedure is documented step by step with calculation sheets and a worked out example to follow. Current high power engines are briefly described and a directory of companies and individuals who are active in Stirling engine development is included. Much remains to be done. Some of the more complicated and potentially very useful design procedures are now only referred to. Future support will enable a more thorough job of comparing all available design procedures against experimental data which should soon be available. Author

N78-24000*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A REVIEW OF NASA-SPONSORED TECHNOLOGY ASSESSMENT PROJECTS
Alfred C. Mascy, Arthur D. Alexander, III, and Richard D. Wood May 1978 59 p refs
(NASA-TM-78472; A-7410) Avail: NTIS HC A04/MF A01 CSCL 05B

Recent technology assessment studies sponsored by NASA are reviewed, and a summary of the technical results as well as a critique of the methodologies are presented. The reviews include Assessment of Lighter-Than-Air Technology, Technology Assessment of Portable Energy RDT&P, Technology Assessment of Future Intercity Passenger Transportation Systems, and Technology Assessment of Space Disposal of Radioactive Nuclear Waste. The use of workshops has been introduced as a unique element of some of these assessments. Also included in this report is a brief synopsis of a method of quantifying opinions obtained through such group interactions. Representative of the current technology assessments, these studies cover a broad range of socio-

political factors and issues in greater depth than previously considered in NASA sponsored studies. In addition to the lessons learned through the conduct of these studies, a few suggestions for improving the effectiveness of future technology assessments are provided. Author

N78-24001# Ohio Legislative Service Commission, Columbus.
SUBURBAN DRAINAGE
Roger D. Warren and Phil Mullin Jun. 1977 77 p refs
(PB-277267/1; STAFF-RR-124) Avail: NTIS HC A05/MF A01 CSCL 13B

This staff report discusses drainage problems in Ohio's suburbs, existing Ohio law and practices concerning these problems, and proposals to deal more effectively with suburban drainage. Engineering solutions exist for most surburban drainage problems. However, before engineering techniques can be applied, the project must be approved and funds must be raised. Therefore, this report focuses more on the political issues of project approval and on methods of financing drainage projects, than on technical issues. GRA

N78-24002# Battelle Pacific Northwest Labs., Richland, Wash.
ECONOMIC COMPARISON OF SLUDGE IRRADIATION AND ALTERNATIVE METHODS OF MUNICIPAL SLUDGE TREATMENT
S. B. Ahlstrom and H. E. McGuire Nov. 1977 170 p refs
(Contract EY-76-C-06-1830)
(PNL-2431) Avail: NTIS HC A08/MF A01

The relative economics of radiation treatment and other sludge treatment processes are reported. The desirability of radiation treatment is assessed in terms of cost and the quality of the treated sludge product. The major conclusions of this study are: radiation treatment is a high-level disinfection process. Therefore, it should only be considered if high levels of disinfection are required for widespread reuse of the sludge; the handling, transporting, and pathogen growback problems associated with disinfected wet sludge makes it less attractive for reuse than dry sludge; radiation of composed sludge produces a product of similar quality at less cost than any thermal treatment and/or flash drying treatment option for situations where a high degree of disinfection is required; and heavy metal concerns, especially cadmium, may limit the reuse of sludge despite high disinfection levels. ERA

N78-24003# Culp/Wesner/Culp Clean Water Consultants, Santa Ana, Calif.
ENERGY REQUIREMENTS FOR MUNICIPAL POLLUTION CONTROL FACILITIES Final Report
Nov. 1977 86 p refs
(Contract EPA-68-03-2186)
(PB-276989/1; EPA-600/2-77-214) Avail: NTIS HC A05/MF A01 CSCL 21D

Information is presented on energy requirements in municipal pollution control facilities for several major areas of interest: (1) pumping energy for filtration and granular carbon adsorption of secondary effluent: Pump of the filtration process. (3) Utilization of anaerobic digester gas; cost estimates are presented for cleaning and storing digester gas, and for use as fuel in internal combustion engines that are coupled to pumps, blowers or electrical generators. (4) Secondary energy requirements; estimations were made for off-site production of some of the consumables used in waste water treatment processes. GRA

N78-24004# Transportation Research Board, Washington, D. C.
GEOMETRICS, WATER TREATMENT, UTILITY PRACTICES, SAFETY APPURTENANCES, AND OUTDOOR ADVERTISEMENT
Joseph Craus 1977 103 p
(PB-276842/2; TRB/TRR-631; ISBN-0-309-02656-3) Avail: NTIS MF A01; National Academy of Sciences, Transportation Research Board, 2101 Constitution Ave., N. W., Washington, D. C. 20418 HC $4.00 CSCL 13B

The 17 papers in this report deal with the following areas: spiral transition curve speed application; communicative aspects in highway design; characteristics of trucks operating on grades; rest-area wastewater treatment; water-reuse for highway rest areas; curb-opening inlets; buried plastic and metal utility lines; uncased natural-gas pipeline crossings of roads and highways; utility relocation as a function of state highway agencies; color markings for underground facilities; computerized mapping and record systems; eliminating vehicle rollovers; barrel trailer for collision protection; upgrading safety performance bridge-railing systems; concrete safety shapes and, control of outdoor advertising. GRA

N78-24005# Urban Mass Transportation Administration, Washington, D.C.
URBAN MASS TRANSPORTATION ABSTRACTS, VOLUME NUMBER 4
Dec. 1977 373 p
(PB-277290/3; UMTA-TRIC-77-1-Vol-4) Avail: NTIS HC A16/MF A01 CSCL 13B

The types of documents abstracted in this volume are, by section: (1) Research, Development, and Demonstration Project Reports; (2) Technical Studies; and (3) University Research and Training Reports. Section (4) contains complete indexes to the volume by report title, personal author, corporate author, geographic location, and keywords. GRA

N78-24006# Washington Environmental Research Center, D.C. Office of Research and Development.
TECHNICAL ECONOMIC ANALYSIS OF SELECTED FEATURES OF MUNICIPAL WASTEWATER CONSTRUCTION GRANT LEGISLATION Final Report
Marshall Rose and Jon Goldstein Aug. 1977 173 p refs
(PB-277473/5; EPA-600/5-77-011a) Avail: NTIS HC A08/MF A01 CSCL 13B

Four main elements of this Federal program were evaluated: the grant formula, the allotment funding process, grant-eligible reserve capacity, and industrial cost recovery. Existing legal provisions, with respect to each of these program elements, are shown to be deficient in terms of their ability to encourage an efficient allocation of abatement resources and to promote an equitable distribution of Federal grant funds. Several options within each program element for improving the principles of construction grant legislation are reviewed. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N78-24007 Florida Univ., Gainesville.
LUNAR OCCULTATION OBSERVATIONS OF THE CRAB NEBULA Ph.D. Thesis
Frank Patrick Maloney 1977 132 p
Avail: Univ. Microfilms Order No. 7806725

Three lunar occultations of the Crab Nebula were observed, two at 114 MHz and one at 26.3 MHz, during the 1974 series of events. The higher frequency observations were deconvolved of diffraction effects to yield four strip integrated brightness profiles of the Nebula, with an effective resolution of 30 arc seconds. These four profiles were Fourier inverted and cleaned of sidelobe structure to synthesize a two-dimensional map of the Nebula. At 114 MHz, the Nebula is composed of a broad envelope of emission which contains several smaller sources. The attenuation of the low radio frequency radiation by the thermal hydrogen in the filaments is considered as a possible mechanism to explain these new data. The 26.3 MHz observations indicate the presence of a bright, localized source containing greater than 80% of the flux of the Nebula. The position of the source is confined by the data to a narrow strip centered at the pulsar position.
Dissert. Abstr.

N78-24008 Florida Univ., Gainesville.
OBSERVATIONS AND ANALYSIS OF U CEPHEI Ph.D. Thesis
Norman Lee Markworth 1977 191 p
Avail: Univ. Microfilms Order No. 7806726

Photoelectric observations of the well-known eclipsing binary system U Cephei commenced following the report of a major outburst on the system in the summer of 1974. Approximately 3200 measurements were obtained from October, 1974, through May, 1976. The reported outburst was observed as well as another outburst of approximately the same intensity in the fall of 1975. A trial-and-error approach produced the coefficients used in the rectification procedure. Shock heating of the surface by infalling material is suggested as the cause of the excess light. Excess temperatures range from 7000-17000 K, yielding mean velocities of the infalling material in the range 12-21 km/s. A magnetic field on the primary star is suggested as the steering mechanism for the infalling material and conclusions based on the model are discussed. Dissert. Abstr.

N78-24009*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
X-RAY SPECTRA OF HERCULES X-1. 3: PULSE PHASE DEPENDENCE IN HIGH ENERGY CONTINUUM
S. H. Pravdo, R. W. Bussard, R. H. Becker, E. A. Boldt, S. S. Holt, P. J. Serlemitsos, and J. H. Swank Mar. 1978 18 p refs Submitted for publication
(NASA-TM-78107) Avail: NTIS HC A02/MF A01 CSCL 03A

Pulse phase-dependent spectral changes in the high energy (less than 20 keV) continuum of Hercules X-1 were observed. Cyclotron absorption of underlying continua can reproduce the observed angular dependence in the high energy cutoff. Implications of this model, which include the possibility of determining the angular separation between the line of sight and the neutron star magnetic field if the absorbing electron spectrum is known are discussed. Author

N78-24010# Mons Univ. (Belgium). Dept. d'Astrophysique.
ULTRAVIOLET STELLAR OBSERVATIONS
L. Houziaux 1977 11 p refs
(Commun-60) Avail: NTIS HC A02/MF A01

Progress achieved in ultraviolet stellar observations using Copernicus high resolution telescope-spectrograph system, mainly in the field of photometric abundances, line lists, and line profile studies; stellar chromosphere and coronae; and extended atmospheres, mass loss, and binary stars is reported. Work at Laboratoire d'Astronomie Spatiale (Marseilles) on ultraviolet stellar observations, ultraviolet stellar spectrophotometer observations onboard TD-1A satellite, ultraviolet photometry television data from the OAO as well as observations from manned spacecraft are briefly summarized. ESA

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N78-24011 Florida Univ., Gainesville.
MAGNETIC BRAKING DURING STAR FORMATION Ph.D. Thesis
Robert Charles Fleck, Jr. 1977 109 p
Avail: Univ. Microfilms Order No. 7806695

Angular momentum is prima facie a formidable obstacle in the theory of star formation: without rotation braking during star formation, stars would rotate with speeds close to that of light. The present investigation suggests that magnetic torques acting on a rotating, contracting, cool interstellar cloud which is permeated by a frozen-in magnetic field coupling the cloud to its surroundings, rotationally decelerate a cloud, constraining it to co-rotate with the background medium. Angular momentum transfer from cool, rotating, stellar-mass condensations, collapsing isothermally on a magnetically-diluted dynamic time scale were examined. Some mechanisms are discussed for forming gravitationally-bound protostellar condensations within cool, dense, molecular clouds. A modified virial approach is employed to calculate time-dependent quantities of interest at cloud's surface in order to estimate the braking efficiency of the magnetic torques. Dissert Abstr.

N78-24012 Cornell Univ., Ithaca, N. Y.
ATMOSPHERIC RED CHROMOPHORES IN THE OUTER SOLAR SYSTEM Ph.D. Thesis
Kathy Ann Rages 1977 102 p
Avail: Univ. Microfilms Order No. 78-06346

An attempt is made to derive the observed reflectivity of Jupiter's North Equatorial Belt from an atmospheric model containing Rayleigh scattering plus a red chromophore, based on the Sagan-Salpeter model of the Jovian atmosphere. The red chromophore candidates examined were mixtures of orthorhombic sulfur and photochemically produced organic compounds. A set of atmospheric models containing an isotropic scattering layer under a thin Rayleigh scattering atmosphere were compared with observations of Titan's geometric albedo and limb darkening at two different wavelengths. A set of radiative-convective equilibrium models of Titan's atmosphere are compared with observations of the microwave brightness in an attempt to place limits on the surface temperature. Hydrodynamic calculations suggest that the red chromophore on Titan can reside in the troposphere only if the eddy diffusion rate is very small. Dissert. Abstr.

N78-24013*# National Aeronautics and Space Administration, Washington, D. C.
PLANETS OF THE SOLAR SYSTEM
K. Ya. Kondratyev and N. I. Moskalenko Apr. 1978 133 p refs Transl. into ENGLISH of "Advances in Science and Technology: Planets of Solar System" Moscow, Viniti, Space Res. Series vol. 7, 1976 p 8-98 and 119-153 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-2790)
(NASA-TM-75299) Avail: NTIS HC A07/MF A01 CSCL 03B

Venera and Mariner spacecraft and ground based radio astronomy and spectroscopic observations of the atmosphere and surface of venus are examined. The composition and structural parameters of the atmosphere are discussed as the basis for development of models and theories of the vertical structure of the atmosphere, the greenhouse effect, atmospheric circulation and cloud cover. Recommendations for further meteorological studies are given. Ground based and Pioneer satellite observation data on Jupiter are explored as well as calculations and models of the cloud structure, atmospheric circulation and thermal emission field of Jupiter. Author

N78-24014*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERPLANETARY PROPAGATION OF FLARE-ASSOCIATED ENERGETIC PARTICLES
Linda S. Masung and James A. Earl (Maryland Univ., College Park) Apr. 1978 53 p refs Submitted for publication
(Grant NGR-21-002-066)
(NASA-TM-79534) Avail: NTIS HC A04/MF A01 CSCL 03B

A propagation model which combines a Gaussian profile for particle release from the sun, with interplanetary particle densities predicted by focused diffusion, was proposed to explain the propagation history of flare associated energetic particles. This model, which depends on only two parameters, successfully describes the time-intensity profiles of 30 proton and electron events originating from the western hemisphere of the sun. Generally, particles are released from the sun over a finite interval. In almost all events, particle release begins at the time of flare acceleration. Author

N78-24039# Joint Publications Research Service, Arlington, Va.
THE NORTH POLAR SPUR: REMNANT OF A SUPERNOVA EXPLOSION
Ya. M. Khazan *In its* Transl. on USSR Sci. and Technol. (JPRS-71181) 25 May 1978 p 54-58 Transl. into ENGLISH from Priroda (Moscow), no. 12, 1977 p 17-19 (For availability see N78-24033 14-99)
Copyright. Avail: Issuing Activity

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N78-24015 California Inst. of Tech., Pasadena.
SILICON VIDICON IMAGING OF JUPITER 4100-8300A: SPECTRAL REFLECTIVITY, LIMB-DARKENING, AND ATMOSPHERIC STRUCTURE, PART 1. SIMULTANEOUS ULTRAVIOLET (0.36 MICROMETER) AND INFRARED (8-20 MICROMETER) IMAGING OF VENUS: PROPERTIES OF CLOUDS IN THE UPPER ATMOSPHERE, PART 2 Ph.D. Thesis
David Joseph Diner 1978 248 p
Avail: Univ. Microfilms Order No. 7805693

The results of high spatial resolution area photometry of Jupiter in six continuum wavelength channels from 4100-8300A are presented. The numerical results are compared to earlier ground-base observations of jovian limb-darkening. Extrapolations of the limb-darkening data to 12 deg phase angle are compared with the results of the Pioneer 10 imaging photopolarimeter (IPP) experiment. The limb-darkening profiles are also compared to models derived from measurements of the spatial distribution of equivalent width of the H2 4-0 S(1) quadrupole line. Some expected numerical values are presented. Also presented is a discussion of high spatial resolution images of Venus which were obtained in 1974, 1975, and 1977 apparitions. In this discussion the observing system, method of image acquisition, and data reduction and processing techniques are presented. Also discussed are the spectral, temporal, and spatial characteristics of the infrared and ultraviolet flux from the planet. The infrared data are compared with previous ground-based results obtained at lower spatial and spectral resolution and Venera 9 and 10 infrared radiometer results. Dissert. Abstr.

N78-24016 California Inst. of Tech., Pasadena.
RADIO INTERFEROMETRIC INVESTIGATIONS OF SATURN'S RINGS AT 3.71 AND 1.30cm WAVELENGTHS Ph.D. Thesis
Frederic Peter Schloerb 1978 229 p
Avail: Univ. Microfilms Order No. 78-06899

The observations were analyzed by both model fitting and aperture synthesis techniques. They show that the rings have a very low brightness temperature, but attenuate the thermal emission from the planet significantly where they cross in front of it. The latter effect, when combined with the estimate of the ring brightness temperature, permits the optical depths of the rings to be estimated. The fits of the interferometric data to Saturn models in which the A and B rings are combined into a single ring are given. The brightness temperature and optical depth results for the individual rings that are implied by all of the 3.71 cm observations are given. The large sizes and excellent scattering properties of the particles indicate that they are composed of either a highly reflective or transparent material. At this time water ice is the most likely candidate.
Dissert. Abstr.

N78-24017 Florida Univ., Gainesville.
HIGHER RESOLUTION STUDIES OF JUPITER'S DECAMETRIC RADIO EMISSIONS Ph.D. Thesis
James Richard Thieman 1977 210 p
Avail: Univ. Microfilms Order No. 78-06759

This dissertation summarizes an analysis of the data for effects not readily apparent from the study of small subsets of the observations. The data in each of ten frequencies in the range from 5.6 to 30 MHz are summarized in histograms of occurrence probability. Apparent in the high-resolution longitude histograms are spectral changes in profile and position of the three probability peaks, often called radio sources A, B, and C. Examination of the data comprising each source for dependence of occurrence probability on the phase of Io reveals asymmetries in the dominant peaks. High-resolution occurrence probability versus longitude histograms for each apparition of the merged 18, 20, and 22-MHz observations confirm the sinusoidal drift of source A with time. No significant trend of changes in the longitude positions of sources B and C were found. Dissert. Abstr.

N78-24018 Johns Hopkins Univ., Baltimore, Md.
THE FAR ULTRAVIOLET SPECTRUM OF SATURN Ph.D. Thesis
Heinz Weiser 1978 144 p
Avail: Univ. Microfilms Order No. 7806281

Far ultraviolet (1160-1750 A) spectra of the Saturnian disk and the ring system were obtained by an evacuated high transmission rocket-borne telescope-spectrograph using a microchannel plate detection system with resistive strip readout. The construction, preparation, flight performance, and calibration stability of the system are discussed. Spatial resolution of the disk and ring spectrum was made possible by the second of arc tracking ability of the telescope and the alternating use of two different size spectrograph entrance apertures. The signal is consistent with an emission brightness of 700 Rayleigh for the disk and 200 Rayleigh for the vicinity of Saturn. A weak emission between 1300 and 1500 A was detected. Disk albedos for 50 A intervals were derived for wavelength longward of 1500 A. Measurements of the ring reflectivity longward of 1650 A are compatible with H2O frost but not NH3 frost.
Dissert. Abstr.

N78-24019 Arizona Univ., Tucson.
SPATIALLY RESOLVED PHOTOMETRY OF JUPITER IN THE 6190, 7250, AND 8900 A METHANE BANDS Ph.D. Thesis
Robert Alan West 1977 89 p
Avail: Univ. Microfilms Order No. 78-05774

Observations of Jupiter have been obtained with the JPL 400 x 400 pixel charge-coupled device at the 1.54 m Catalina telescope. The observations were taken in narrow-band filters at three methane and three nearby continuum wavelengths. Standards stars were also observed. Calibration data was obtained to remove instrumental effects. Uncertainty in the relative (pixel to pixel) photometry is 2%. Uncertainty in the absolute photometry is 8%. The data are of superior quality than has been achieved in previous studies by other investigators because of the combined spatial, photometric, and time resolution of the data presented here. The center-to-limb variations of intensity across several of the Jovian cloud bands were extracted. The models considered here are diffuse reflecting-scattering models (BSM), and two-cloud models (TCM). Models were computed with and without a high haze layer. Dissert. Abstr.

N78-24020 Michigan Univ., Ann Arbor.
INFRASOUND FROM ACCURATELY MEASURED METEOR TRAILS Ph.D. Thesis
David Ray Kraemer 1977 151 p
Avail: Univ. Microfilms Order No. 78-04741

Infrasonic signals generated by meteor entry into the earth's atmosphere were measured by an array of microphones established near Sioux Falls, S.D. The trajectories of the meteors have been precisely determined from photographs. Three meteor entries are examined in detail. One of these produced sounds that were measured at the microphone array; the other two did not. The nature of the measured infrasound is closely compared with the predicted values of the idealized cylindrical line source model for meteor sound. Necessary modifications to the existing theory are presented. The fact that sounds were not received at the microphone array for the two remaining meteors is shown to be consistent with the cylindrical line source theory.
Dissert. Abstr.

N78-24021 Michigan Univ., Ann Arbor.
THE IONOSPHERE OF VENUS Ph.D. Thesis
Robert Hsin Chen 1977 151 p
Avail: Univ. Microfilms Order No. 78-04668

The coupled continuity-momentum and energy balance equations are solved simultaneously and with time dependence for CO2(+), O2(+), O(+), He(+), H(+), electron temperature and composite ion temperature for an altitude range of 120 to 500 km around the globe of Venus from the subsolar point to the terminator. Horizontal bulk motions arising from neutral winds carrying the ions are included in the calculation. Electron heating

rates are calculated using the two-stream photoelectron transport method. Electron and ion energy exchange and diffusion processes are treated. In addition to the solar zenith range variation calculation further studies included, an investigation of the effects of different boundary conditions on both the energy and ion density equations; a calculation of equilibrium time constants using applied perturbations; and a nightside ionosphere calculation using a mono-energetic electron beam as the ionizing source.
Dissert. Abstr.

N78-24022*# National Aeronautics and Space Administration, Washington, D. C.
REPORTS OF PLANETARY GEOLOGY PROGRAM, 1977-1978
Robert Strom, comp., Joseph Boyce, comp., A. P. Boss, S. J. Peale, H. Alfven, A. G. W. Cameron, C. P. Sonett, E. M. Shoemaker, E. F. Helin, and A. Carusi May 1978 356 p refs
(NASA-TM-79729; SL-4) Avail: NTIS HC A16/MF A01 CSCL 03B

A compilation of abstracts of reports which summarizes work conducted by Planetary Geology Principal Investigators and their associates is presented. Full reports of these abstracts were presented to the annual meeting of Planetary Geology Principal Investigators and their associates at the Universtiy of Arizona, Tucson, Arizona, May 31, June 1 and 2, 1978. Author

N78-24023*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A BEAMING MODEL OF THE Io-INDEPENDENT JOVIAN DECAMETER RADIATION BASED ON MULTIPOLE MODELS OF THE JOVIAN MAGNETIC FIELD
Melvyn L. Goldstein, Aharon Eviatar (Tel-Aviv Univ.), and James R. Thieman Apr. 1978 40 p refs Submitted for publication
(NASA-TM-79537) Avail: NTIS HC A03/MF A01 CSCL 03B

A geometrical model is presented in which the apparent source locations of the Io-independent decameter radiation are computed. The calculations assume that the radiation is produced by stably trapped electrons radiating near the electron gyrofrequency and that the emission is then beamed onto a conical surface. The maximum occurrence probability of noise storms is associated with regions in the Jovian magnetosphere where the axis of the emission cone is most inclined toward the Jovian equatorial plane. The calculations utilize and compare two of the octupole spherical harmonic expansions of the Jovian magnetic field constructed from data accumulated by the fluxgate and vector helium magnetometers on board Pioneer 11. Author

N78-24024*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MARTIAN CANYONS AND AFRICAN RIFTS: STRUCTURAL COMPARISONS AND IMPLICATIONS
Herbert Frey May 1978 34 p refs Submitted for publication Prepared in cooperation with Maryland Univ., College Park
(Grant NGL-21-002-033)
(NASA-TM-79548) Avail: NTIS HC A03/MF A01 CSCL 03B

The resistant parts of the canyon walls of the Martian rift complex Valled Marineris were used to infer an earlier, less eroded reconstruction of the major roughs. The individual canyons were then compared with individual rifts of East Africa. When measured in units of planetary radius, Martian canyons show a distribution of lengths nearly identical to those in Africa, both for individual rifts and for compound rift systems. A common mechanism which scales with planetary radius is suggested. Martian canyons are significantly wider than African rifts. The overall pattern of the rift systems of Africa and Mars are quite different in that the African systems are composed of numerous small faults with highly variable trend. On Mars the trends are less variable; individual scarps are straighter for longer than on earth. This is probably due to the difference in tectonic histories of the two planets: the complex history of the earth and the resulting complicated basement structures influence the development of new rifts. The basement and lithosphere of Mars are inferred to be simple, reflecting a relatively inactive tectonic history prior to the formation of the canyonlands. Author

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N78-24025 Maryland Univ., College Park.
OBSERVATIONS OF SOLAR FLARE PARTICLE ANISOTROPIES FROM 1.0 TO 4.7 AU Ph.D. Thesis
John Joseph McCarthy 1977 198 p
Avail: Univ. Microfilms Order No. 78-05017

The anisotropy of protons produced by solar flare particle events was studied using the University of Chicago Charged Particle Instrument Main Telescope on the Pioneer 10 and 11 spacecraft. The observations were made during 1972 and 1973 and covered a range of solar radial distances of 1.0 to 4.7 AU. Using a model of cosmic ray diffusion to analyze the anisotropy observations, it was determined that the diffusion coefficient of 3-10 Mev protons travelling parallel to the magnetic field is: K sub 11 (r)=(9.78 plus or minus 2.3) times 10 to the 21st power r(1.01 plus or minus 0.24) sq cm/sec where r is the radial distance in AU. The corresponding three dimensional radial diffusion coefficient is K sub r sub 3 (r)=(1.35 plus or minus 0.32) times 10 to the 21st power r(-(0.63 plus or minus 0.24)) sq cm/sec. Comparison of these numbers with other experimental results is made, and theoretical implications are discussed.
Dissert. Abstr.

N78-24026 Maryland Univ., College Park.
THE APPLICATION OF Si III LINE INTENSITY RATIOS TO DETERMINE THE SOLAR TRANSITION ZONE DENSITY AND PRESSURE Ph.D. Thesis
Kenneth Robert Nicolas 1977 228 p
Avail: Univ. Microfilms Order No. 7805018

In order to develop the new plasma diagnostic for Si III, electron and proton collision cross sections and intersystem radiative transition probabilities had to be calculated. The calculations of these parameters are discussed. The observed values of the density sensitive line ratios (R) are compared with curves of the theoretical ratio of the emissivities, R(Ne), of selected lines. The sensitivity of R(NE) to errors in the atomic parameters is studied. The Si III density sensitive line ratios were used together with several other density diagnostics from C III and O IV to interpret new ultraviolet observations between 1175 A and 1950 A. Empirical models for a quiet solar region and a flare are constructed. Dissert. Abstr.

N78-24027 California Inst. of Tech., Pasadena.
AN INVESTIGATION OF TECHNIQUES FOR THE MEASUREMENT AND INTERPRETATION OF COSMIC RAY ISOTOPIC ABUNDANCES Ph.D. Thesis
Mark Edward Wiedenbeck 1978 241 p
Avail: Univ. Microfilms Order No. 78-06900

An instrument, the Caltech High Energy Isotope Spectrometer Telescope (HEIST), was developed to measure isotopic abundances of cosmic ray nuclei. Measurements of particle trajectories and energy losses are made using a multiwire proportional counter hodoscope and a stack of CsI(T1) crystal scintillators, respectively. A detailed analysis was made of the mass resolution capabilities of this instrument. A formalism is developed for obtaining isotopic abundance ratios at the cosmic ray sources from abundances measured in local interstellar space for elements having three or more stable isotopes, one of which is believed to be absent at the cosmic ray sources. This technique is illustrated for the isotopes of the elements O, Ne, S, Ar and Ca. The uncertainties in the derived source ratios due to errors in fragmentation and total inelastic cross sections, in observed spectral shapes, and in measured abundances are evaluated. Dissert. Abstr.

N78-24028# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 401, JANUARY 1978. PART 1, PROMPT REPORTS: DATA FOR DECEMBER - NOVEMBER 1977
Helen E. Coffey Jan. 1978 119 p
(PB-278143/3; SGD-401-Pt-1; NOAA-78021604) Avail: NTIS HC A06/MF A01 CSCL 03B

This prompt report provides data for December 1977 on:

alert period, daily solar indices, solar flares, solar radio waves, solar X-ray radiation, coronal holes, solar wind measurements, inferred IP magnetic field polarities and mean solar magnetic field. It also provides data for November 1977 on: daily solar activity center, sudden ionospheric disturbances, solar radio waves, cosmic rays, geomagnetic indices, and radio propagation indices. GRA

N78-24029# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 401, JANUARY 1978. PART 2, COMPREHENSIVE REPORTS: DATA FOR JULY - JUNE 1977 AND MISCELLANEA
Helen E. Coffey Jan. 1978 52 p
(PB-278144/1; SGD-401-Pt-2; NOAA-78021605) Avail: NTIS HC A04/MF A01 CSCL 03B

This comprehensive report for July 1977, June 1977 and miscellaneous data provides data on: active regions, synoptic solar maps, solar flares, solar radio waves, energetic solar particles and plasma, synoptic chart, abbreviated calendar record, regional flare index, solar radio waves and cosmic rays. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N78-24030 Texas A&M Univ., College Station.
COSMIC RAY PRODUCED NOBLE GASES IN MESOSIDERITE METEORITES Ph.D. Thesis
Dennis Arthur Edgerley 1977 143 p
Avail: Univ. Microfilms Order No. 7806791

Mass spectrometric analysis of the noble gas isotopes were performed on the mesosiderites, Clover springs, Crab Orchard, Patwar, and Hainholtz with comparative analyses also conducted on the achondrites, Binda and Pavlovka. All samples were found to be rich in cosmogenic neon and argon. The N-21/N-22 ratio showed a large variation, between 0.83 and 1.00, indicating a definite dependence on the combined effects of target element abundance and cosmic ray shielding. The shielding effect seems to be especially pronounced in the mesosiderites. The Ar-36/AR-38 ratio for spalation was found to be approximately 0.65. Cosmic ray exposure ages determined from cosmogenic argon abundances fall in the range 40 to 87 myr for mesosiderites. Crab Orchard gave a K-Ar age of 3.2 times 10 to the 9th power yr. The Binda achondrite gave 44 myr and 3.2 times 10 to the 9th power yr respectively for cosmic ray exposure and K-ARr ages. Dissert. Abstr.

N78-24031*# California Univ., Berkeley. Dept. of Physics.
VARIATIONS IN THE SPATIAL DISTRIBUTION OF 11 MICRON RADIATION FROM OMICRON CETI
E. C. Sutton, J. W. V. Storey, C. H. Townes, and D. L. Spears (Lincoln Lab., MIT, Lexington) [1977] 14 p refs
(Grants NGL-05-003-272; NSF AST-77-12256)
(NASA-CR-156992) Avail: NTIS HC A02/MF A01 CSCL 03B

The spatial distribution of 11 micron radiation from omicron Ceti was observed at various phases of its light cycle using a stellar interferometer. Changes were seen which can be attributed to variation in the strength of thermal emission from circumstellar dust relative to the stellar continuum at 11 microns. These changes are shown to be correlated with the changes in luminosity of micron Ceti in such a way that dust grain emission at 11 microns was increased more than the continuum during the period of maximum luminosity. The degree of the change in dust grain emission implies that the maximum dust temperature is in the range of 500 K to 700 K during minimum stellar luminosity. Author

N78-24032*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBSERVATIONS OF MEDIUM ENERGY GAMMA RAY EMISSION FROM THE GALACTIC CENTER REGION
D. A. Kniffen, D. L. Bertsch, D. J. Morris, R. A. Palmeira (Inst. de Pesquisas Espaciais, Sao Paulo, Brazil), and K. R. Rao (Inst. de Pesquisas Espaciais, Sao Paulo, Brazil) Apr. 1978 32 p refs
(NASA-TM-79543) Avail: NTIS HC A03/MF A01 CSCL 03B

Measurements of the gamma-ray emission in the medium energy range between 15 and 100 MeV, obtained during two ballon flights from Brazil are presented. The importance of this energy region in determining whether pi deg - decay of electron bremsstrahlung is the most likely dominant source mechanism is discussed along with the implications of such observations. Specifically, the data from this experiment suggest that emission from the galactic plane is similar to theoretical spectrum calculations including both sources mechanisms, but with the bremsstrahlung component enhanced by a factor of about 2. A spectral distribution of gamma-rays produced in the residual atmosphere above the instrument is also presented and compared with other data. A rather smooth spectral variation from high to low energies is found for the atmospheric spectrum. Author

99 GENERAL

N78-24033# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: PHYSICAL SCIENCES AND TECHNOLOGY NO. 37
25 May 1978 92 p refs Transl. into ENGLISH from various Russian journals
(JPRS-71181) Copyright. Avail: Issuing Activity

Soviet advances are reported in automation technology, surface acoustic wave devices, signal processing, gyroscopic stability, and the optimum correction of inertial navigation systems. Visual observations of earth by cosmonauts and the Skylab crew are described, as well as investigations of the North Polar Spur. Launching facilities at the Baykonur Cosmodrome are described and illustrated. For individual titles, see N78-24034 through N78-24041.

N78-24034# Joint Publications Research Service, Arlington, Va.
INVESTIGATING THE EXCITATION OF ACOUSTIC WAVES IN PLATES **c71**
V. V. Burliy, I. Ya. Kucherov, I. V. Ostrovskiy, and V. M. Pergal *In its* Transl. on USSR Sci. and Technol. (JPRS-71181) 25 May 1978 p 17-22 refs Transl. into ENGLISH from Izv. Vysshykh Uchebn. Zavedenii Radioelektron. (Kiev), vol. 21, no. 3, 1978 p 25-28 (For availability see N78-24033 14-99)
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The excitation of zero modes of acoustic waves in plates yz - LiNbO3 was considered. Single-phase arrays and interdigital transducers (VShP) for waves in plates are described by formulas for VShP of surface waves. The experiments were carried out on plates 80 microns thick where the symmetrical and antisymmetrical modes were excited in the range of 4.5-17 MHz. Measurement of the conductivity of transducer emission on frequency and the number of periods agree with those calculated theoretically. The introduced losses in the matched mode were 9-10 db at a band of 13 percent. Author

N78-24035# Joint Publications Research Service, Arlington, Va.
MEASURING SELSYN ROTOR ANGLE OF ROTATION CONVERTER **c35**
T. M. Aliyev, R. M. Mirsalimov, and V. B. Ibragimov *In its* Transl. on USSR Sci. and Technol. (JPRS-71181) 25 May 1978 p 23-26 refs Transl. into ENGLISH from Izv. Vysshykh Uchebn. Zavedenii Priborostr. (Leningrad), vol. 21, no. 2, 1978 p 5-8 (For availability see N78-24033 14-99)
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Circuit diagrams are given for a device to be used for linear conversion of the angle of rotation of a servomotor rotor angle to an electric signal phase and then to a digital code. Components of the device include a selsyn, a matching transformer, a

linearization block which compensates for the nonlinearity of the selsyn conversion characteristic, and a phase measurement block. Author

N78-24036# Joint Publications Research Service, Arlington, Va.

THE EFFECT OF LINEAR ACCELERATION ON THE STABILITY OF A DYNAMICALLY TUNED PRECESSION GYROSCOPE c35

V. A. Kuzinov *In its* Transl. on USSR Sci. and Technol. (JPRS-71181) 25 May 1978 p 27-32 refs Transl. into ENGLISH from Izv. Vysshykh Uchebn. Zavedenii Priboroster. (Leningrad), vol. 21, no. 2, 1978 p 72-76 (For availability see N78-24033 14-99)

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The effect of one-component radially aligned linear acceleration of the base on the stability of a dynamically tuned Howe gyroscope was analyzed on the basis of vector matrix representation of the differential equations of a gyroscope. The gyroscope equations, after a number of transformations, are represented in the form of a matrix power series by powers of small parameter. The representative matrices of the first and second approximations by which the stability of the gyroscope is analyzed are determined on the basis of methods used to investigate matrix equations with small parameter. Author

N78-24037# Joint Publications Research Service, Arlington, Va.

SELECTING THE SPACE OF STATES AND MEASUREMENTS IN PROBLEMS OF OPTIMUM CORRECTION OF INERTIAL NAVIGATION SYSTEMS c04

V. A. Karakashev, S. G. Romanenko, and A. S. Filippov *In its* Transl. on USSR Sci. and Technol. (JPRS-71181) 25 May 1978 p 33-40 refs Transl. into ENGLISH from Izv. Vysshykh Uchebn. Zavedenii Priborostr. (Leningrad), vol. 21, no. 2, 1978 p 76-82 (For availability see N78-24033 14-99)

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The feasibility of analog representation of errors of multiple navigation systems and the possibility of obtaining optimum linear estimates of the analog errors of an inertial coordinate system, simulated in inertial navigation systems, are demonstrated. Advantages over the classical form are explored. Author

N78-24038# Joint Publications Research Service, Arlington, Va.

ROCKET LAUNCHING FACILITIES AT BAYKONUR DESCRIBED c14

B. P. Vladimirov *In its* Transl. on USSR Sci. and Technol. (JPRS-71181) 25 May 1978 p 41-53 Transl. into ENGLISH from Zemlya i Vselennaya (Moscow), no. 1, 1978 p 64-71 (For availability see N78-24033 14-99)

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The movement and preparation of a rocket from time of construction to launching at the Baykonur cosmodrome are discussed. Facilities such as the launching pad and the servicing laboratory are described. Author

N78-24039# Joint Publications Research Service, Arlington, Va.

THE NORTH POLAR SPUR: REMNANT OF A SUPERNOVA EXPLOSION c90

Ya. M. Khazan *In its* Transl. on USSR Sci. and Technol. (JPRS-71181) 25 May 1978 p 54-58 Transl. into ENGLISH from Priroda (Moscow), no. 12, 1977 p 17-19 (For availability see N78-24033 14-99)

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X-ray observations indicate that the North Polar Spur (NPS) is the remnant of the explosion of some object. It is premature, however, to affirm with confidence that the explosion of a supernova led to its formation. The problem is that only the angular dimensions of the spur have been measured directly. In order to determine the fundamental characteristics of the explosion, such as the initial energy of the ejected gas, the actual distance to the North Polar Spur must be known. Estimates of this distance, based on the polarization of the light of stars resulting from its scattering by interstellar dusts, may be erroneous if there is another area lying closer on the same line of sight where polarization of the starlight also takes place. Estimates of the distance, based on the absorption of X-rays in the interstellar gas, are larger than those determined by optical observations. If the distance to the NPS is larger, then the spur must be located in the central part of the galaxy, and its diameter may be as large as 10,000 parsecs. Only the explosion of a galactic nucleus could lead to the production of such a large object. A.R.H.

N78-24040# Joint Publications Research Service, Arlington, Va.

COSMONAUTS STUDY THE EARTH c46

G. A. Ivanyan and K. Ya. Kondratyev *In its* Transl. on USSR Sci. and Technol. (JPRS-71181) 25 May 1978 p 59-68 Transl. into ENGLISH from Priroda (Moscow), no. 12, 1977 p 48-55 (For availability see N78-24033 14-99)

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The great possibilities of space observation of earth stem from the highly developed capacity of human vision to distinguish extremely fine variation in the color and brightness of various surfaces and atmospheric formations, and to detect objects and follow their movements. Because of manned space flight, a number of geophysical phenomena were observed for the first time. Soviet cosmonauts reported the vertically rayed structure of diurnal radiation in the upper atmosphere, the luminescence in the areas of the southern magnetic pole, the existence of a luminescence layer on the nocturnal side of the earth (whisker effect), and the specular reflection of solar radiation by the atmosphere when the sun is low in the horizon. Many of these observations became the foundation of the theory of the twilight halo of the earth. One of the most interesting visual observations was made of mesospheric (silver) clouds during the flight of Soyuz-9. Activities of the Skylab crew in using EREP instrumentation is described, as well as the special observations they elected to make. A.R.H.

N78-24041# Joint Publications Research Service, Arlington, Va.

VISUAL OBSERVATION OF THE NATURAL ENVIRONMENT FROM AN ORBITAL STATION c43

L. V. Denisov *In its* Transl. on USSR Sci. and Technol. (JPRS-71181) 25 May 1978 p 69-75 Transl. into ENGLISH from Priroda (Moscow), no. 12, 1977 p 56-61 (For availability see N78-24033 14-99)

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The first systematic Soviet experiment in the visual evaluation of the state of the natural environment was performed in two stages of the manned flight program in the Salyut-5 station during the summer of 1976 and the winter of 1977. The distinguishing characteristic of the experiment was the use of a specially designed optical view-finding instrument. The aim of the experiment was the development of methodological foundations for visual observation of earth. Space photographs on a scale of 1:2,500,000 were used in training and during the flight. Top priority was accorded to observations of geological objects, such as the Sevan fault, the Baykal rift system, and active volcanoes. Snow and ice conditions in the mountainous regions of Central Asia and South America, dust storms in the Takla Makan desert, forest and grass fires, and flooded jungle areas were also observed. Environmental pollution near petroleum refineries, dust clouds from open-pit mines, and the saturation and color contrasts on the water surface of the world oceans were explored. A.R.H.

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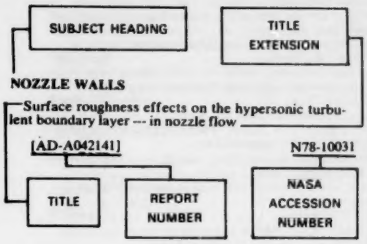

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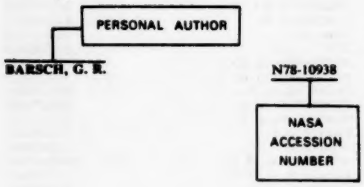

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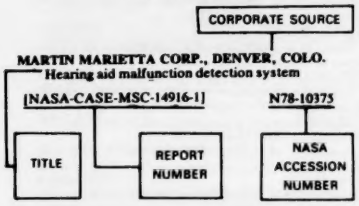

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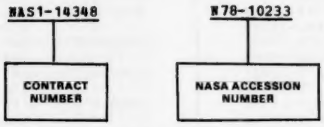

Listings in this index are arranged alphanumerically by contract number. Under each contract number the NASA accession numbers denoting documents that have been produced as a result of research done under that contract are arranged in ascending order. The NASA accession number denotes the number by which the citation is identified.

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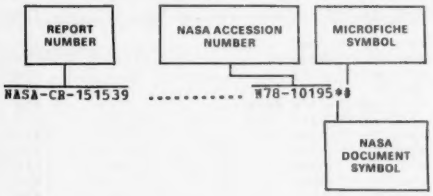

Listings in this index are arranged alphanumerically by report number. The NASA accession number denotes the number by which the citation is identified. An asterisk (*) indicates that the item is a NASA report. A pound sign (#) indicates that the item is available on microfiche. Accession numbers followed by a plus sign (+) are not available on microfiche because of size or reproducibility.

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ARO-13514.1-MS ..... N78-23204 #
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